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WITH WHICH IS INCORPORATED

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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTION OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION.

Institution of British Foundrymen.
PRESIDENT, 1922-1923, Mr. H. L. Reason, A.M.I.Mech.E., Holloway Head, Birmingham.

LIST OF SECRETARIES—

General Secretary: W. G. Hollinworth, 38, Victoria Street, London, S.W.1.

Lancashire: T. Makemson, 21, Beresford Road, Gorse Hill, Stretford, Manchester.

Birmingham: D. Wilkinson, 1,114, Bristol Road, Northfield, Birmingham.

Sheffield and District: W. A. Macdonald, 62, Bannerdale Road, Sheffield.

Scottish: W. H. Bound, 69, Minard Road, Shawlands, Glasgow.

London: V. C. Faulkner, 21, Stanley Gardens, W.11.

Newcastle-on-Tyne: H. A. J. Rang, 2, St. Nicholas Buildings, Newcastle-on-Tyne.

East Midlands: H. Bunting, 17, Marcus Street, Derby.

Coventry: J. M. Meston, 37, Melville Road.

West Ridings of Yorkshire Branch: A. Love, 232, Gladstone Street, Bradford.

Welsh Engineers' and Founders' Association.
Secretary: E. J. Griffiths, 20, Fisher Street, Swansea.

The Birmingham Conference.

At the Birmingham Conference, for the first time in the history of British foundry practice, there has been a representative gathering of foundrymen, and on this the Birmingham Branch of the Institution of British Foundrymen is to be congratulated. The Conference was more than of national character, as American, French and Belgian delegates were also present. Mr. Stanley Flagg, junior, a past-President of the American Foundrymen's Association, and Professor Enrique Tonceda, represented the States; Mons. Ramas, the President of the French Foundrymen's Association, and Mons. Ronceray were the French delegates; whilst Belgium was represented by Mons. Leonard, the President of the Belgian Foundrymen's Association, and Mons. Voilet. There is no doubt that the Exhibition was the chief contributory cause of the success of the Conference, and British foundrymen as a whole owe a deep debt of gratitude to the Birmingham Chamber of Commerce for its foresight in recognising that such a demand existed. A further important factor was the propaganda which has been carefully organised during the past year by the immediate Past-President, Mr. Oliver Stubbs, of Manchester. Mr. Stubbs has travelled over 27,000 miles, and everywhere has constantly preached the cause of the British foundrymen in general and its representative technical institution in particular. Unquestionably, the Institution has gained enormously in status under his efficient leadership. His year of office will be commemorated by the initiation of the Oliver Stubbs Medal. This will probably become recognised in the future as the highest honour a foundryman can get, and will be an incentive to apprentices, not so much to receive the medal, from a mere value point of view, but to have their names listed with that of Mr. F. J. Cook, the popular first recipient, and others who will follow. The success of the Institution of British Foundrymen is due almost entirely to the continued interest of its Past-Presidents. It is a lead which its Branches should strive to follow. There were at the Conference no fewer than six Past-Presidents—Messrs. Matt. Riddel, T. H. Firth, J. Ellis, F. J. Cook, Robt. Buchanan, and Dr. P. Longmuir.

The newly-elected President, Mr. H. L. Reason, has an excellent lead to follow. He is a very old and respected member of the Institution, who has done sterling work for its welfare, and in every way deserves the high honour conferred upon him. We believe his election is unique in so far as he is the first non-ferrous foundryman to wear the Presidential chain. We feel sure he will make it one of his first duties to expand the work of the Institution amongst non-ferrous foundrymen, where there is ample scope for useful activity.

The international aspect of the Conference was of extreme importance, and is one which will be developed in the future. Whilst the war brought the allied nations nearer together, post-war conditions, due to the unstability of the currency exchanges, coupled with the expense of travelling, have, if anything, widened the breach, but now that there is some prospect of getting back to normal we shall not rest until a real International Foundrymen's Congress has been convened. We have been assured that the Americans are perfectly prepared to cross the Atlantic, the French already envisage such an affair in the early future, and the Belgians are wholeheartedly in sympathy with the movement. It is now for British foundrymen to make up their minds to co-operate in every way possible with the movement. Finally, on behalf of the British foundry trades, we offer our heartiest thanks to the Lord Mayor of Bimingham, Ald. David Davis, to the Reception Committee, to the Birmingham Chamber of Commerce, and to all others who have contributed in making the Birmingham Conference the largest and most successful meeting of foundrymen ever held in this country. To Mr. H. L. Reason we offer our sincere congratulations, and trust his term of office may be one of peace and prosperity for the engineering industries.

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List of Members Attending the Conference.

M. N. Abaza (Ipswich), H. C. Buckmaster (Wigan), Edgar M. Boote (Coventry), Gerald S. Bell (Lincoln), Robt. Buchanan (Past-President, Birmingham), Percy Butterfield (Sutton-in-Craven, Joseph P. Bayley (Newport, Mon.), Geo. H. Baker (Towcester), H. Bradley (Sheffield), Thos. Bell (Barrhead), William Bell (Glasgow), E. H. Broughall (Coventry), A. R. Bartlett (London), F. J. Cook (Past-President, Birmingham), W. J. Cooper (Bromsgrove), E. M. Currie (Coventry), Nich. Curry (Camborne), John H. Cross (West Bromwich), Frank M. Cramb (Bath), F. J. Cree (Peterborough), Thos. H. Chappelow (Batley), F. Critchley (Bolton), H. F. Clements (Newcastle), A. Campion (Falkirk), R. Carrick (Shipley), John G. Dobson (Birmingham), E. Doughty (Manchester), T. B. Derry (Peterborough), J. Duncan (Dalmuir), David Dalrymple (West Bromwich), J. W. Donaldson (Greenock), W. T. Evans (Derby), C. Edgington (Chesterfield), C. W. Evans (Cymbran), H. Cole Estep (London), J. Ellis (Past-President, London); J. E. Fletcher (Dudley), Thos. H. Firth (Past-President, Sheffield), M. Fosseprez (London), Geo. H. Foston (Coventry), Vincent C. Faulkner (London); A. Field (Birmingham), F. W. Finch (Hon. Treasurer, Gloucester), J. W. Frier Wallsend), J. Feasey (Lincoln), C. Grest- (Wallsend), H. Griffiths (Cardiff), M. E. Gallon (Dunston-on-Tyne), Jos. Hogg (Burnley), W. J. Hollinworth (General Secretary, London), T. Hill (Airdrie), F. B. Holberry (Birmingham), F. H. Hurren (Coventry), T. Housby (Ipswich), B. Hird (Reading), C. E. Hemming (Birmingham), F. Holberry (South Wales), C. Heggie (Birmingham), H. M. Hodgart (Paisley), John R. Hyde (Sheffield), A. Harley (Coventry), A. Hodgson (Manchester), John Haigh (Wakefield), B. Hipkins (Loughborough), A. Harcky (Colne), R. Hargreaves (Manchester), W. H. Ingall (Wednesbury), H. Jowett (Rochdale), H. Jewson (Senior Vice-President, Dereham), J. B. Johnson (Tipton), P. Jump (Birmingham), W. Jolly (Manchester), F. Johnson (Birmingham), C. W. Kent (Manchester), J. Kerfoot (Loughborough), Arthur R. Lee (Manchester), Wesley Lambert (London), F. H. N. Lane (Coventry), David Landale (Kirkcaldy), P. Longmuir (Past-President, Sheffield), A. Love (Bradford), W. J. Molineaux (Stafford), T. W. Markland (Bolton), J. M. Macaulay (Wolverhampton), T. McFarlane (Horsehay, Salop), W. H. Moore (Birmingham), T. D. McGrah (Sheffield), J. McLachlan (Birkenhead), J. McEachen (Kirkintilloch), A. Morris (Sunderland), W. A. Macdonald (Sheffield), James M. Meston (Coventry), H. Mather (Birmingham), F. A. Melmoth (Braintree), W. H. Meadowcroft (Tyldesley), A. D. Mackenzie (Edinburgh), T. Mackemson (Manchester), H. B. Mason (Barrow), C. Mace (Manchester), G. Mackay (Paisley), A. D. Melford (Ferrol, Spain), R. A. Miles (Newton Heath), Harry Newby (West Bromwich), E. Oakdon (Manchester), James Oswald (London), W. O'Keefe (Birmingham), Chas. A. Otto (London), John Pell (Burnley), Joseph Picken (Dosley Dawley, Salop), F. Perkins (Newcastle, Staffs.), R. O. Patterson (Junior Vice-President, Wylam-on-Tyne), H. Pemberton (Derby), R. Place (Birmingham), J. S. G. Primrose (Ipswich), L. C. Pott (Walsall), G. C. Pierce (London), W. N. Pellatt (Bolton), W. Parker (Halifax), W. H. Poole (Bradford), Chas. Retallack (Willenhall), H. A. J. Raag (Tynemouth), Edward J. Rang (Tynemouth), Matt. Riddell (Past-President, Falkirk), J. G. Robinson (Halifax), William Robertson (Falkirk), W. B. Richardson (Farnworth), A. Rennie (Falkirk), H. L. Reason (President, Birmingham), W. Raincar (Tyldesley), S. H. Russell (Leicester), F. Russell (Sheffield), R. L. Rankin (Alexandria, N.B.), G. E. Roberts (Coventry), J. Riley (Oldham), F. G. Smith (Loughborough), C. Scampton (Coventry), S. Smith (West Bromwich), H. O. Slater (London), J. E. Smethurst (Warrington), Robt. Shaw (London), E. Stevenson (Nottingham), A. Smith (Barnsley), A. T. Smith (Barnsley), Edward Smith (South Shields), James Smith (South Shields), J. S. Sinclair (Towcester), H. Sherburn (Warrington), J. Shelley (Birmingham), E. A. Smith (Birmingham), J. W. Sykes (Leeds), J. Shaw (Sheffield), H. Simpson (Horsehay), J. N. Simm (Monkseaton), H. Scott (Cork), W. H. Smith (Airdrie), S. G. Smith (Manchester), B. F. Sperring (Portsmouth), F. G. Starr (Birmingham), H. R. Shakleton (Keighley), A. Sutcliffe (Bolton), Oliver Stubbs (Past-President, Manchester), C. W. Tate (Burnley), Thos. Turner (Birmingham), A. E. Taylor (Gloucester), D. R. Tullis (Glasgow), W. Thornton (Bradford), E. H. Tyson (Birmingham), J. H. Westwood (Smethwick), H. E. Webster (Birmingham), E. Wood (Wallsend), Ernest N. Wright (Wolverhampton), Wm. R. Wilson (Liverpool), R. C. Waddell (Glasgow), Anderton Wardle (Wolverhampton), W. Whitehouse (Halesowen), B. Webb (Dudley), H. Winterton (Birmingham), C. F. Walker (Wolverton), Thos. Wilkinson (Middlesbrough), D. H. Wood (Birmingham), S. W. Wise (Dunston-on-Tyne), W. Wilkinson (Birmingham), H. J. Young (Newcastle-on-Tyne).

The Oliver Stubbs Medal.

The first medal was awarded to Mr. F. J. Cook, a past-President of the Institution of British Foundrymen. Mr. Cook has just returned from

the States after reading the first British Exchange Paper with the American Foundrymen's Association.

Our illustrations show the reverse and obverse sides of the Oliver Stubbs medal.

Conference Note.

Reception of Mr. Stanley Flagg.

Private enterprise was responsible for the reception of Mr. Stanley Flagg, Junior, a Past-President of the American Foundrymen's Association. He was met on his arrival from London by his host, Mr. Frank Somers, of Halesowen; Mons. Ramas, President of the Association Technique de Fonderie de France; Mr. H. Cole Estep, Member of Committee on Papers, A.F.A.; Mons. E. V. Ronceray, of Paris; Mr. V. C. Faulkner, of London; and Mr. Pritchard, of Birmingham. After mutual introductions, the party were motored to the "Watt Room," where they were shown the various clever machines which have been left untouched since the great engineer died over one hundred years ago. The guests were naturally much interested in all they saw of the work done by one who had done so much to revolutionise the world's progress. The guests were afterwards motored to the home of Mr. Somers for dinner.

INSTITUTION OF BRITISH FOUNDRYMEN.

ANNUAL CONFERENCE AT BIRMINGHAM.

Civic Welcome.

The nineteenth annual meeting and conference opened on Wednesday, June 21, at the Chambers of Commerce Building, the hall being filled with members from all over the Kingdom. The retiring president, Mr. Oliver Stubbs, took the chair during the first part of the proceedings, having with him on the platform the Lord Mayor of Birmingham (Alderman David Davis), the Principal of the University of Birmingham (Mr. G. Grant Robertson), the President of the Birmingham Chamber of Commerce (Mr. F. Hickinbotham), the ex-President of the Chamber (Mr. J. C. Field), and the Secretary of the Institution (Mr. W. G. Hollinworth). Among representatives from other countries present were Mr. S. Flagg and Prof. E. Touceda, America; MM. E. Ramas and E. V. Ronceray, France; MM. J. Leonard and J. Varlet, Belgium.

MR. H. L. REASON
(President of the Institution of British Foundrymen.)

Mr. Reason is general manager of the Birmingham Works of the United Brass Founders and Engineers, Limited, Holloway Head. He has twice occupied the chair of the Birmingham Branch of the Institution, and in 1915 he received the Institution's diploma for a contribution on "Non-ferrous Alloys." During the war Mr. Reason was a member of an Air Board Committee set up to deal with the standardisation of aircraft fittings.

THE LORD MAYOR offered a hearty welcome to the Institution. Remarking that Birmingham was the birthplace of the Institution in 1904, but that it had not received a visit from the members collectively since 1909, he expressed a hope that the next interval would not be so long. Their object, so far as he gathered from the charter, was extremely simple—to learn from one another. There was a time when a great deal of suspicion existed on the part of manufacturers with regard to those who desired to see their factories and the processes carried on in them. He thought that period had passed away in favour of a freer exchange of learning.

PRINCIPAL GRANT ROBERTSON said that in the Birmingham University they were closely associated with some of the objects and purposes of the Institution. They had great departments of applied science, above all in engineering and in metallurgy, and their Professor of Metallurgy (Professor Turner), who had a distinguished name in the science that the Institution represented, was present at the Conference as one of their members. It was their object and duty in the University—through science, through education, through research, through the training of character—to assist as far as they possibly could the prosperity of the great industries, particularly in the Midlands. There never was a time in British industry when trained brains were of more importance for our industrial future.

MR. HICKINBOTHAM, in echoing the welcome, acknowledged the assistance which had been given by the Institution of British Foundrymen and the British Cast Iron Research Association towards making the Foundry Exhibition at Bingley Hall a success. It was one of the desires of traders like himself that they should be more associated with the work of education.

THE RETIRING PRESIDENT thanked the Lord Mayor, the Principal, and the President of the Chamber of Commerce for their welcome, and said he was particularly gratified that they had there an international gathering, and that it had been the privilege of the Institution of British Foundrymen to do something to bring about a better understanding between nations than had been accomplished in political quarters. It had been his pleasure recently, along with their Past-Presidents, Mr. T. H. Firth and Mr. F. J. Cook, to visit the United States. They had an opportunity of meeting their American friends, or, as he should say, their American cousins, and he hoped that as a result of their visit they brought the English-speaking races very much closer together. He trusted all present would do all they possibly could to increase the friendship that had been so happily inaugurated. They had a great pride in their Institution. They were purely a technical body; they were not dealing with labour or commercial matters, but were endeavouring to help each other so that they would be better able to stand in competition and take that place in the world to which they were entitled, and which he still believed they held, as first in the foundry industry. They were downright glad to see their visitors from America, France, and Belgium. (Applause.) He would beg the Lord Mayor before he left to present the Oliver Stubbs gold medal to Mr. F. H. Cook, who had been unanimously indicated as the member of the Institution who in the opinion of the Council had rendered the most meritorious service during the year.

MR. W. G. HOLLINWORTH
(The General Secretary of the Institution of British Foundrymen).

MR. COOK was greeted with musical honours on ascending the platform to receive the medal. The

Lord Mayor made the presentation in a few well-chosen sentences.

MR. COOK, in reply, said the position was the most embarrassing, but the most pleasing, he had ever occupied. He had always had a deep interest

THE OLIVER STUBBS MEDALLIST.
MR. F. J. COOK, PAST-PRESIDENT.

in the Institution and its work, and had been proud to serve it.

The Lord Mayor and those who had accompanied him to welcome the members of the Conference then withdrew.

Greeting to Prince of Wales.

THE RETIRING PRESIDENT said, knowing they were a loyal body, he had that morning sent the

THE PRESIDENT, MR. H. L. REASON.

following telegram in their name to the Prince of Wales at York House :—

"The Institution of British Foundrymen in conference at Birmingham extend their best wishes upon your safe return, and trust the objects of your visit have been entirely fulfilled.—OLIVER STUBBS, President."

Salutations Between Britain and America.

THE RETIRING PRESIDENT next read a cablegram which he had sent in the name of the Institution to Mr. Cook, to be read at the American Foundrymen's Congress, as follows :—

"Convey heartiest greetings to President and members with all good wishes for successful convention and inspirations of International Foundrymen's Congress in near future.—OLIVER STUBBS, President, Institution of British Foundrymen."

Mr. Cook had brought home from America the following letter in reply, addressed to the Institution of British Foundrymen :—

"Gentlemen,—The cordial greetings and messages of goodwill from the Institution of British Foundrymen were delivered to us by your representative, Mr. F. J. Cook. His paper was a most helpful contribution to our festival session, and caused much favourable comment. We are indebted to Mr. Cook and to your Institution.

"The visits of Messrs. Stubbs, Firth and Cook have done much to make us feel closer to you,

"SEMI-STEEL": MR. J. CAMERON, KIRKINTILLOCH.

and it is our hope that visits between representatives of your Institution and our Association may continue in the future. British and American Foundrymen have much in common, and nothing but good can come from personal contact and exchange of ideas. Your representatives have made us appreciate this, and we hope that they realise our friendly feeling for you, and will carry this thought to your Institution.

"The subject of an International Foundrymen's Congress is being given much thought by us, and we hope the establishment of such a congress is not far off.

"Accept our thanks for your messages, our best wishes for your meeting and exhibition, and the hope that you may succeed in all you undertake. Believe us to be, yours most sincerely,—AMERICAN FOUNDRYMEN'S ASSOCIATION (C. R. MESSINGER Vice-President."

A further message from their American friends, dated June 17, was as follows :—

"Accept heartiest congratulations and best wishes for your meeting and first exhibition. Visit

of your splendid representatives has done much to stimulate genuine friendship between your Institution and our Association, which we hope will grow stronger in all things. In the future co-operation between us will mean much to both countries.—AMERICAN FOUNDRYMEN'S ASSOCIATION."

Annual Report and Balance Sheet.

The report and balance-sheet, as circulated in printed form, were next submitted, and passed.

The report of the Council and the balance-sheet which are presented herewith were taken as read.

The General Council have pleasure in presenting to the members their report of the progress and work of the Institution during the past session, 1921-22.

Four General Council meetings have been held during the session—at Blackpool, York, Birmingham, and Manchester respectively. Representatives of the Branches from all parts of the country have attended the meetings, and there has been an average attendance of twenty-five.

"BURNLEY WILL BE SELF-SUPPORTING": MR. J. HOGG, BURNLEY.

The respective Branches have the following members attached:—

	Members.	Associate Members.	Associates.	Total.
Birmingham	47 (50)	96 (99)	20 (35)	163 (184)
Coventry	29 (33)	64 (92)	8 (34)	101 (159)
East Midlands	29 (35)	61 (89)	9 (18)	99 (142)
Lancashire	85 (84)	139 (148)	3 (7)	227 (239)
London	74 (75)	64 (54)	7 (6)	145 (135)
Newcastle-on-Tyne	85 (77)	108 (92)	30 (36)	223 (205)
Scottish	69 (68)	162 (160)	50 (73)	281 (301)
Sheffield	85 (82)	96 (104)	15 (13)	196 (199)
West R. of Yorks	27	14	—	41
General	17 (30)	12 (26)	—	29 (56)
Totals	547 (534)	816 (864)	142 (222)	1505 (1620)

The figures in brackets are for the Season 1920-1921.

The figures in brackets are for the Session, 1920-1921.

In addition to the figures shown above, there are seven members, thirteen associate members, and four associates whose election has been confirmed, but whose subscriptions have not yet been paid. Excluding the latter, the total number of members on the roll of the Institution on April 30, 1922, was 1,505, showing a decrease for the session of 75. It is necessary to state, in part explanation of the decreased membership, that no name is included in the list where subscription is owing for 1920 and onwards. Five deaths have been recorded.

Whilst a number of members have been lost during the past year, principally on account of the severe depression in trade in many parts of the country, and in a few instances through the necessary increase in subscriptions, it is satisfactory to your Council to be able to report that the losses have been diminished to a large extent by the acquisition of new members in nearly every Branch, due mainly to the efforts of Branch officers and the

AUTOMOBILES AND WATCHES: MR. G. E. ROBERTS, COVENTRY.

growing desire of others in the trade, who have recognised the advantage of being connected with an institution like our own.

Subscribing Firms.—The members will be pleased to know that up to the present twenty-seven subscribing firms have been elected. The Council feel assured that many more could be induced to be-

"SULPHUR-MANGANESE BALANCE": MR. H. J. YOUNG, NEWCASTLE.

come subscribing firms by a little effort on the part of our members. The Newcastle Branch has eleven, Sheffield six, Lancashire five, Coventry four, London one, and the West Ridings of Yorks Branch has submitted one for confirmation at the next General Council meeting.

National Ironfounding Employers' Federation.—The offer of the N.I.E.F. of £200 for the awarding

of a gold medal, to be known as the "Oliver Stubbs Medal," was gratefully accepted by your Council, and rules and regulations governing the gift have been circulated to the members. The first medal will be awarded at the coming conference.

Royal Charter.—This has been granted by H.M. Privy Council during the year, and a copy of the Charter may be had by members who have subscribed to the special fund for this purpose. The total legal charges have been settled for £500. The total sum obtained by private donations and bank interest up to the time the Charter was granted amounted to £406 14s. 10d., showing the sum of £93 5s. 2d. required to clear off the solicitor's account. The question of raising the balance without touching the funds of the Institution was considered at the General Council meeting held in Manchester in March last, and it was decided to endeavour to raise the requisite amount in donations from members who had not previously contributed. The sum of £58 7s. was promised or handed to the General Secretary in the Council room, or sent since, leaving the difference still to be obtained of £34 18s. 2d.

It is felt by the Council that a number of our

"I VENTURE TO SAY EVERY MEMBER SHOULD VISIT THE U.S.A.": MR. OLIVER STUBBS, PAST-PRESIDENT.

members will appreciate the privilege of having had a share in the Royal Charter Fund and their being asked to help to clear off the balance without its being a charge on the Institution funds. This will be specially pleasing to those who initiated the project and liberally subscribed to the same.

British Cast Iron Research Association.—The Council are pleased to report that this Association, which was formulated by our Institution in 1919, has during the past year appointed a member of the Institution, Mr. J. E. Fletcher, M.I.Mech.E., as the Director of Research. Some important foundry problems have been investigated for its members and a series of researches upon fundamental problems have been commenced, which will be of very great benefit to the members of our Institution and the industry generally. Six members of the Institution Council are on the Council of the Association, and the Institution is also officially represented by Mr. H. L. Reason and Mr. E. H. Broughall.

British Engineering Standards Association.—Our representatives are Messrs. R. Buchanan and F. J. Cook. Mr. Buchanan has been appointed chairman of a sub-committee to deal with grey iron castings, and Mr. Cook as chairman of sub-committee to deal with malleable castings for automobiles.

Standardisation of Test Bars.—The sub-committee appointed report progress *re* this. The views of the Branch committees have been received and the information is being tabulated for discussion and further consideration.

The Director of Research has been appointed to represent the British Cast Iron Research Association, and the specification, when submitted to General Council, will embody the views of both Associations.

The British Engineering Standards Association have intimated that our views will be welcomed, and, where possible, will be embodied in future specifications, if they meet with the wishes of the committee dealing with the subject.

Other Committees.—In addition to the committees previously named, others have been formed during the year to deal with new rules to comply with the Royal Charter requirements, and publications.

General Council.—The members who are retiring in accordance with the rules are Messrs. E. H. Broughall, A. Hayes (both desire not to be re-

"YOU SHOULD TRY MAKING CASTINGS WITHOUT FEEDING HEADS YOURSELVES": MONS. RONCERAY, PARIS.

elected) and Mr. John Shaw, who is willing to further serve the interests of the Institution. Five will require to be elected at Birmingham to complete the ten members as per rules.

New Section at Burnley.—This was opened in the autumn of last year, and is making satisfactory progress.

New Branch at Bradford.—This has now been opened under the title of the West Riding of Yorks Branch, and is progressing satisfactorily.

New London Office.—A new central office has been taken at 38, Victoria Street, London, S.W.1, which is quite satisfactory for our requirements.

The General Council have pleasure in recording the visit of your President, Mr. Oliver Stubbs, and Past-President, Mr. T. H. Firth, to the United States of America. During the visit they were the guests of the American Foundrymen's Association, and were given a very enthusiastic and generous reception. Mr. F. J. Cook, a Past-President, is presenting a Paper to the American Foundrymen's Association at their annual Convention in June, and, as you will see by our Convention programme, we are to have a Paper by

Professor E. Touceda, who will present the same on behalf of the American Foundrymen's Association. We are also being favoured with papers by members of the French and Belgian foundrymen's societies. Your Council attach very much importance to the interchange of papers, and hope in the future much more progress will be made in this direction.

The accounts and balance-sheet of the Institution are presented herewith:—

INCOME AND EXPENDITURE ACCOUNT,
From 1st January to 31st December, 1921.

EXPENDITURE.

	£	s.	d.
Postages	70	9	7
Printing and Stationery, including Printing of Proceedings	380	8	10
Council, Finance and Annual Meeting Expenses	45	13	10
BRANCH EXPENSES:—			
Lancashire £52 3 2			
Birmingham 33 5 4			
Scottish 79 3 11			
Sheffield 43 13 6			
London 43 10 10			
East Midlands 22 11 4			
Newcastle 47 8 2			
Coventry 30 1 4			
	351	17	7
Illuminated Addresses	6	6	0
Audit Fee	6	6	0
Incidental Expenses	11	3	10
Salaries—Secretarial Staff	300	0	0
Rent of Office	50	0	0
Bank Charges and Interest	1	17	4
Depreciation—Furniture, etc.	8	4	0
Balance of Income over Expenditure	283	17	6
	£1,516	4	6

INCOME.

	£	s.	d.
Subscriptions Received	1,421	4	6
Sale of Proceedings, etc.	5	10	0
Interest on War Loan	22	10	0
Rent Received, Heating and Ventilating Engineers	25	0	0
Income Tax Refunded	42	0	0
	£1,516	4	6

BALANCE SHEET,
31st December, 1921.

LIABILITIES.

	£	s.	d.	£	s.	d.
Subscriptions paid in advance				155	18	6
Sundry Creditors				250	0	0
ROYAL CHARTER FUND—						
Balance per last Account	£251	4	4			
Interest on Deposit to date	5	10	6			
	255	14	10			
Less: Payment to Solicitors	200	0	0			
				56	14	10
Surplus at 31st December, 1920	255	14	4			
Add: Excess of Income over Expenditure for the year ended 31st December, 1921	283	17	6			
				539	11	10
				£1,002	5	2

ASSETS.

	£	s.	d.	£	s.	d.
CASH IN HANDS OF SECRETARIES, VIZ.:—						
Lancashire	6	8	2			
Birmingham	2	12	11			
Scottish	15	4	7			
Sheffield	42	10	3			
London	5	2	1			
East Midlands	9	6	8			
Newcastle	22	4	10			
Coventry	5	18	7			
	£109	8	1			
General Secretary, Petty Cash	3	15	1			
				113	3	2
London Joint City and Midland, Bank, Ltd.—						
General Account	326	1	11			
Royal Charter Fund Account	56	14	10			
				382	16	9
Investment Account—						
5 per cent. National War Bonds and 5 per cent. War Loan at cost				432	10	1
Furniture, Fixtures and Fittings—						
Per last Account	81	19	2			
Less: Depreciation 10 per cent.	8	4	0			
				73	15	2
				£1,002	5	2

We have prepared and audited the above Balance-Sheet with the Books and Vouchers of the Institution, and certify same to be in accordance therewith.

J. & A. W. SULLY & Co.,
Chartered Accountants, AUDITORS.
19/21, Queen Victoria Street, London, E.C.4.
April 24, 1922.

Election of President.

MR. STUBBS next proposed the election of Mr. H. L. Reason as his successor in the presidency, remarking that with Mr. Reason at the head of affairs they would be in safe hands.

DR. LONGMUIR (Sheffield), as a Past-President, seconded the nomination, and in endorsing Mr. Stubbs's encomiums, said they liked to have men of Mr. Reason's type to direct their destinies.

MR. M. RIDDELL (Falkirk), as another Past-President, supported the motion, which was unanimously carried. The new President was hailed with great enthusiasm when Mr. Stubbs, having divested himself of the chain of office, mounted a chair to place it on the herculean shoulders of his successor.

Presentation to Mr. Riddell.

Between this ceremony and the President's reply there was interposed the presentation of an illuminated address in album form to Mr. Riddell in recognition of his eminent services in the chair and in other ways. Mr. Stubbs handed over the testimonial.

Mr. Riddell, in response, said some people did not look with favour on the foundrymen; they thought theirs was a rather low status, but he intended to uphold the dignity of the Institution as long as he had breath.

THE PRESIDENT, thanking the Conference for the honour conferred upon him in his election to the chair, said he looked upon it as an honour done also to the Birmingham Branch of the Institution, which had rendered yeoman service to their cause. Having regard to the nominations that were coming forward for the future, there was every hope and prospect of the next Conference being held in Newcastle. He paid a tribute to the work of his immediate predecessor, observing that they would all connect with Mr. Stubbs's year of office his propaganda efforts with the National Ironfounders' Federation and the cementing of the friendship between this country and the United States by the visit he paid to their American cousins.

Election of Officers.

MR. T. FIRTH (Sheffield), proposing Mr. H. Jewson (East Dereham) as senior Vice-President, said Mr. Jewson had been associated with them for a large number of years, and had been a regular attendant at the Council meetings. He was sure that in him they would find a very capable President when his turn came to occupy the chair.

MR. M. RIDDELL (Falkirk) seconded, and said Mr. Jewson was one of the oldest members of the Institute; in fact, he was one of the five original members who were present that day.

MR. JEWSON, having been unanimously elected, returned thanks, and said the Institution had his heartiest sympathy and support. He loved the work of the Institution, and, so far as he was able, he would in every way do all he could during the coming year to support the President. At the same time, he hoped they would understand the difficulty he had to face in the fact that, being situated in the centre of Norfolk, it took him a whole day to get to Birmingham.

MR. OLIVER STUBBS proposed Mr. R. O. Patterson (Wylam-on-Tyne) as junior Vice-President. Mr. Patterson was President of the Newcastle Branch, which was one of the strongest in the Institution, and they were all aware of the good work he had done.

MR. F. J. COOK (Birmingham) seconded, remarking that those who had had any connection with the Newcastle Branch would know the valuable work Mr. Patterson had done there. He was sure Mr. Patterson would leave nothing undone to make the efforts of the Institution successful.

The proposition being carried, MR. R. BUCHANAN (Birmingham) proposed that Mr. F. W. Finch (Gloucester) be re-elected Hon. Treasurer, which MR. H. SHERBURN (Warrington) seconded. This was also carried unanimously; MR. FINCH, in reply, acknowledging the vote by saying it would give him the greatest pleasure to continue in office.

THE PRESIDENT next intimated that five members were to be elected on the Council. There were eight nominations, and he would ask Messrs. Firth and Riddell to act as scrutineers. The result of the ballot was subsequently announced as follows, those gentlemen whose names are marked with an asterisk seeking re-election:—Elected: A. R. Bartlett, London; * J. Shaw, Sheffield; * H. Pemberton, East Midlands; H. Sherburn, Lancashire; * H. H. Broughall, Coventry.

The President moved that Messrs. R. Buchanan, F. J. Cook and W. Mayer (Dumbarton) be re-elected trustees, which was agreed to; and also that Messrs. J. & A. W. Sully & Company be re-appointed auditors, which was carried.

The Presidential Address.

Gentlemen,—

It is thirteen years ago since our Convention was held in Birmingham, this being our nineteenth Convention, and on behalf of the East Midlands, Coventry and Birmingham Branches, I extend to you all a very hearty welcome. It is extremely pleasing to the Conference Committee that in their arduous work under the guidance of the Reception Committee all classes of citizens have participated to make the Conference both enjoyable and interesting.

The progress our Institution has made and continues to make must be very gratifying to every member. Had it not been for the moulders' strike, which was followed by the terrible slump in trade, I think our membership would have been doubled.

Subscribing Firms.

Although it is only just over two years ago since we added subscribing firms to our membership, we have already enrolled 27 firms, and as time goes on and firms recognise and appreciate the valuable work our Institution is doing for the industry, we shall not be counting them in tens, but hundreds.

One of the Original Members: Mr. Robert Buchanan, Past-President.

Royal Charter.

The fact that the King, after making the fullest investigations into the nature of our work, has seen fit to grant the Institution a Royal Charter in recognition of the great work we are doing, should be sufficient recommendation for all time to convince anyone of the importance of our work. In connection with this we should place on record our indebtedness to our Past President, Mr. T. H. Firth, whose efforts to raise the Institution to the level of our other great Institutions have been crowned with success.

Position of the Institution.

It should give the members much pleasure to know that the Institution is now in a stronger position as regards membership and finance than it has ever been in its history. As soon as the funds of the Institution permit we have still a large field for extending the scope of our work, and I would like to make two suggestions, the first of which is that we should present every member upon joining the Institution with a book containing formulæ and useful information on foundry work such as:—Air required in cupola melting. Weight of castings from weight of pattern. Weight of metals. Pouring temperature. Approximate melting points. Annealing temperatures. There is a good deal of tabulated information that when put into book form for easy reference would be of invaluable help to the student of foundry problems. I believe that the effect of such a book on new members who wish to make a study of foundry work and improve their technical knowledge would be far reaching, and the information would form the basis for their future studies.

The second has reference to the publication of Papers. I consider all Papers read before the Institution should be circulated in full, with discussions to every member, instead of the present method of issuing copy of proceedings once annually with a selection of Papers. A commencement should be made by having two publications, the first mid-way in our Session, say, January, and the other as soon as possible after the sessions are closed. These could be supplemented by monthly bulletins giving a short summary of current developments, similar to the American Foundrymen's Association.

Diplomas and Medals.

During the past year important developments have taken place in this direction to encourage members to write Papers. In addition to the diplomas which are presented for the best Paper read at each Branch annually, our Past-President, Mr. Mayer, has invested a sum of money, the interest from which will provide a gold and silver medal, to be presented for the best Paper read each year at the Scottish and Newcastle Branches alternatively. In order to perpetuate the name of Mr. John Surtees, of Newcastle, who did important pioneer work in connection with loam and dry sand moulding, the medals are to be called the John Surtees Memorial Medals.

"Automobile Cylinders": Mr. W. T. Evans, Derby.

Oliver Stubbs Medal.

In addition to these medals the National Ironfounding Employers' Federation have invested a sum of money, the interest of which will provide a gold medal to be competed for by the whole of the members of the Institution, and it has been our privilege and pleasure to see the Lord Mayor present the first medal. This medal has a threefold purpose. It is a token of appreciation from the members of the National Ironfounding Employers' Federation for the great services Mr. Stubbs has rendered, and it is their wish that his name shall for all time be associated with the industry.

It gives those who do important work for the industry through our Institution a token of recognition.

It shows that the employers recognise and appreciate the important work our Institution has done, and is doing, for the ironfounding industry.

British Cast Iron Research Association.

As there appears to be some misunderstanding in connection with the work and functions of the Association and our Institution, I propose to explain that whilst the work of both is to improve foundry productions, there is a distinct line of demarcation. The Institution of British Foundrymen enable all foundry workers, whether they are moulders, foremen, managers or proprietors, to attend meetings at which valuable Papers are read and discussed. The three important features in connection with this are:—The writer of the Paper derives great benefit from his research work. Every member has the privilege of joining in the important discussions which follow the reading of all Papers. By the exchange of views, and members keeping themselves posted up with the most up-to-date methods of production both as regards material and finish, it will readily be seen by this

"TEST-BARS": MR. J. SHAW, SHEFFIELD.

means the Institution does some of its most valuable work.

With a body of men determined and anxious to take advantage of every modern development there are bound to be numerous instances where from lack of funds, apparatus or laboratories it has not been possible to carry important research work forward to a successful conclusion. It is at this point where the employers, assisted by the Government, come in and take an equal share as the British Cast-Iron Research Association, with a view to carrying forward valuable research work that would benefit the industries, and to organise an Information Bureau containing all existing data in connection with foundry work carefully indexed for the use of all its members.

The information that is being continually requested varies from what some would call elementary to the most difficult propositions which require research, but it will be appreciated that from the questions asked the greatest difficulties in the industries can be located and earmarked for research.

Whilst we realise the important research work that can be done to improve the ironfounding industries it is very gratifying to know that whilst the Government were exploring every avenue to effect economy they realised that to withdraw the grants to industrial research would be a step in the wrong direction, and they would be failing in their duty if they did not assist our industries to keep first position among the leading industrial nations of the world.

Research Work.

If an example was needed to point out the necessity of research work a splendid illustration is given by Sir Robert Hadfield, who, in a recent Paper, stated that the world's output was about 1,860 million tons, of which 660 millions (or nearly one-third) were lost by rusting in use. For the year 1920 the loss by rusting during use has been estimated at 29 million tons, the annual cost being probably over 700 million pounds sterling. Members visiting the Exhibition will be interested to see Dr. J. Newton Friend's exhibit showing the effect of rust in its various stages in connection with various metals.

Seeing the developments that have recently taken place in connection with rustless steel it is only fair to assume that in the near future developments will also occur with regard to cast iron.

From the foregoing remarks I have endeavoured to make it clear that there is ample room for both the British Cast-Iron Research Association and the Institution of British Foundrymen in the iron-

"THE INTERPRETER": MR. V. C. FAULKNER, LONDON.

founding industry. It is not generally understood that practically all industries owe their birth and sustenance to the iron and steel foundries.

International Foundry Trades Exhibition.

In the exhibition there are 1,000 tons of the most modern foundry equipment, with between 300 and 400 h.p. to exhibit same under working conditions, together with pig-iron, alloys, sands, refractories, also fine examples of foundry productions. One of the outstanding features of the Exhibition is the air drying oil sand core, which disposes with the necessity of core drying stoves, in fact there is almost everything to assist the foundryman to produce sound castings.

You will be interested in an extract from a letter we have received from Sir Robert Hadfield in connection with the Exhibition:—

"As one of the Honorary Members of the Institution of British Foundrymen, and a member of the British Cast-Iron Research Association, I should like to offer my heartiest good wishes for the success of this important Exhibition. Exhibitions of this nature for several years have been arranged in the United States and have proved of great educational value. I sincerely trust that the same results will follow here

"The foundryman is often given a secondary position in the technical world. Just why this is

I do not know. The greatest possible skill, patience, and high technique are required by those conducting foundry operations, whether master or moulder. Some of the greatest technical achievements to-day depend upon the skill shown in the foundry, whether as regards cast-iron, cast steel or non-ferrous alloy castings.

"I hope a special effort will be made to interest the workmen themselves by those conducting the Exhibition so as to increase the value of the work of the foundryman, which is a fascinating art."

The Exhibition is the result of a great enterprise under most difficult conditions, and it should be placed on record that it is the outcome of propaganda work by the Midland branches of the Institution of British Foundrymen. I am led to believe the splendid Exhibition in connection with foundry equipment will be such an education that from now onwards there will be a rapid decline in obsolete methods of production.

Before concluding I should like to say how pleased we are that our 1922 Convention should be held when peace is again reigning in our industry. Without being unduly optimistic I share the view of many others that with the lock-out ended

"WELL! WHAT ABOUT IT": MR. H. A. J. RANG, NEWCASTLE.

it is the earnest desire of both employed and employers to take full advantage of the revival that has begun to show itself in trade, and I hope at the end of my year of office we shall be able to look back upon a year that has been freed from both industrial and political anxieties of the last few years, and the peace and prosperity we are longing for will have reigned in its place.

DR. LONGMUIR (Sheffield) proposed that a hearty vote of thanks be given to the President for his splendid address, which he said had supplied them with a good deal to think about, and the motion, after being seconded by MR. JEWSON, was carried with acclamation.

Charter Fund.

THE SECRETARY announced in regard to the special fund for meeting the changes in connection with the Royal Charter that the previous night 17 guineas was subscribed by the Council, which left a balance of 7 guineas more to raise in order to clear themselves. To this statement THE PRESIDENT added that members of the Council were particularly anxious that the whole of the fund should be subscribed voluntarily, and as a result of further subscriptions there and then it was announced the following day that only 7 guineas more were required to close the fund.

THE ANNUAL DINNER.

University Efforts to Aid Industrial Prosperity.

The annual dinner of the Institution was held at the Grand Hotel, on Wednesday evening, the President (Mr. H. L. Reason) being supported by a distinguished company. The function was a complete success. A special item in the musical programme, which attracted general attention was the appearance of Madame S. H. Tring, the President's daughter, who sang in charming style. THE PRESIDENT proposed the loyal toast, and referred appreciatively to the Prince of Wales' visit to India. He also asked Prof. Turner to remedy an omission in the earlier proceedings by proposing a hearty vote of thanks to the retiring Presidendent and the officers for their services during the year.

PROF. TURNER said the work Mr. Oliver Stubbs had done called for their special recognition. He had, amongst other things, done all that was possible to promote international understanding among foundrymen; the foundrymen of America, France, Belgium, and other parts of the world who were associated with them, not only in competition and friendly rivalry, but also in mutual help. The vote was carried with enthusiasm

MR. OLIVER STUBBS, who proposed the toast of "The City and Commerce of Birmingham,"

"SPOON-FED EDUCATION REINFORCES IGNORANCE": MR. MATT RIDDELL, PAST-PRESIDENT, FALKIRK.

pleaded for a practical interest in education. If they had paid greater attention to education they would probably be taking a greater part in the world's commerce to-day. In America the main part of the business population would, in the course of no very distant time, be educated at the universities. While Manchester was known for its cotton, Bradford for its wool, and Sheffield for its steel products, Birmingham had a reputation for its brass ware; but Birmingham was also remarkable in that it was the centre of a greater variety of industry than any other town could boast. He urged that the improvement of the canal for traffic would help to reduce freights, and finally mentioned that the dies for the medal presented to Mr. Cook were made in the city.

THE LORD MAYOR (Ald. David Davis), in reply, remarked that the Foundry Trades Exhibition at Bingley Hall was one of which the city might well be proud; and referring to the University, said it was working in harmony with the commercial and industrial community to raise the standard of education.

MR. F. HICKINBOTHAM (President of the Chamber of Commerce) also responded, and after expressing the view that trade was gradually improving and giving reasons therefore ventured to say that the cry they had heard about Germany capturing the trade of the world was mere moonshine. From reports which they had read, and which many of

them had received from private sources, it would appear that things were not always what they seemed. If they could only keep their heads and avoid any fresh difficulties in the way of strikes or lock-outs, he saw no reason why the improvement which had set in should not continue.

MR. C. GRANT ROBERTSON, Principal of Birmingham University, gave the chief toast of "The Institution of British Foundrymen," and in a humorous opening leading up to a serious essay on industry and education, referred to the important position held by the Institution in the industrial and commercial life of the country. How else the reading of Papers, inexhaustible in their application, how otherwise a rising membership, and how else the tackling so seriously of those problems with which their Institution was concerned. The large attendance that night and the success of the exhibition proved this importance. He sincerely congratulated them on the exhibition, and hoped the consequences to them of its success would be a large number of orders. Proceeding, he pointed to the close relation between the efficiency of higher education and the prosperity of industry, and spoke of what Birmingham University and Manchester University, among the modern seats of learning, were doing to promote industrial and commercial progress. He therefore thought that the Universities were entitled to get full support of their ally in the great struggle to maintain the industrial supremacy of Great Britain. In the United States and in Germany the work that had been done and the money spent on universities, apart from the ethereal, political or civic consequences, had brought in large industrial dividends. They, in England, whatever their shortcomings in the past, were now alive to their needs, and they did want the enlightened leaders of industry to keep in close touch with university life. It was part of the Birmingham University policy to become associated with the best industrial thought and activities in the city and the Midlands, and he gratefully acknowledged the help which he had received from the leaders of industry and those connected with the business of the city during the last two years. One of the functions of the universities was to train and produce the research worker, and in discussing the value of research as a primary essential in progress, he said that he was delighted to see that the Institution was giving cordial support to research in the proper sense of the term in the interests of the great trades and industries they represented.

THE PRESIDENT, in response, reviewed the history of foundry work, and said they had now arrived at a stage when they made automatic machines, fitted with magazines, which had to be charged with castings which must be regular in shape and size. The ironfounder had now to produce castings not only perfect in shape, but sound in every detail, and such as to stand severe tests and adhere to the most rigid specifications. Indeed, the iron industry to-day had arrived at a stage when it was going to take its proper place in the engineering world. For a long time past engineers had come to them for castings of this nature, and almost expected the machine; they did not want to do any work at all in fitting a casting, and if they had to put a file on a casting they were apt to grumble, so that to-day they had really to produce in the foundry the finished article; and hence with the minimum amount of grinding or shaping the various parts could be assembled, and there was the complete machine. He thoroughly endorsed what Principal Grant Robertson had said in regard to holding their place in the industrial world. They had now to work more closely in accordance with the scientific control of the foundry by taking full advantage of the research work and facilities offered by universities, chemists and metallurgists. Concluding, the President expressed very great pleasure that their gathering was of such an international character—France, Belgium and America being represented by some of its foremost men—and complimented the Convention Committee on the splendid arrangements which had been made for the Conference meetings.

MR. C. RETALLACK proposed the health of "The Guests," and SIR HERBERT AUSTIN and MR. S. G. FLAGG (America) responded. Sir Herbert said that the engineering world had waked up to the fact that "anything would do in the foundry" was no longer possible. Given improved accommodation and equipment, foundries would turn out better work. While the American foundryman could make malleable castings to very fine limits, he supposed they in Great Britain were able to make steel almost as fine. The exhibition at Bingley Hall proved this. At Longbridge they could obtain much better results from steel than from malleable castings, perhaps because they had gone into the matter a little more.

SECOND DAY.

When the Conference was resumed on Thursday morning the attendance was not so large as on the opening day, but there was a big muster of members, who manifested a keen interest in the technical problems introduced for discussion by specialists at home and abroad. Precedence was given, on the initiative of the President, to the Papers by the French and Belgian visitors.

A Newcastle Convention.

During an interval in the second session on Thursday the President mentioned that an exhibition was on view at Birmingham Technical School, which had gone to a lot of trouble to arrange it for their inspection. The next Convention, he announced, would be held in Newcastle owing to circumstances over which they had no control. Dr. Johnson had asked him to make the announcement, and he was doing so at this early stage for two reasons; first, that members of the London Branch would know the exact position, and, secondly, that the gentlemen of the Newcastle Branch would know that from that day they would have to take steps to make the necessary arrangements.

Foreign Visitors Honoured.

THE PRESIDENT next proposed that the Convention elect Mons. E. Ramas, Mons. J. Leonard, Mr. S. Flagg, Prof. E. Tonceda, Mons. J. Varlet, and Mr. D. McLain as honorary members. He coupled Mr. McLain's name with the others because that gentleman was to have read a Paper, but it could not be got through in time to include in the programme. His motion was in the nature of a token of friendship and of appreciation of the visit to their Conference of these gentlemen, a visit which, to all intents and purposes, made it an international gathering; and they desired to show in a practical way how much they did appreciate their presence, which had gone a long way to making a success of the Convention. (Applause.) Mr. Flagg and Mons. Ronceray, he added, were already members of the Institution, but would be changed to honorary membership.

MR. F. J. COOK seconded, and in testifying to the desire of their American friends for closer touch with them, said he was looking forward to a larger international meeting in two or three years' time. The proposition was carried with acclamation.

MONS. RAMAS then acknowledged the honour, Mr. Faulkner interpreting the speech by saying: The President of the French Foundry Association thanks you very sincerely, in the name of the French Foundrymen's Technical Association, and also on behalf of Belgium and America, for the great honour you have done to his Institution and to them. He thanks his English comrades for the very kind reception accorded to him and for the enjoyable time they have given him. The sentiments of fraternity which existed between us during the war will, he has not the slightest hesitation in saying, be developed; and as they have already divided the sacrifices of war, they will go forth into the future with exactly the same confidence as has existed in the past.

New Methods of Testing Cast Iron.

The various Papers were then read and discussed.

At the close of Thursday's session a resolution was proposed by THE PRESIDENT that the heartiest thanks of the Convention be passed to the authors of the Papers for the valuable information placed before them. So far as the character and quality of the Papers and their number were concerned, he said they could safely take credit to themselves for having the best Convention in their history.

XUM

MR. HARLEY (Coventry) seconded, and the vote was carried with acclamation.

THE PRESIDENT obtained the ready consent of the meeting to despatch messages of sympathy with Mr. Charles Jones, Mr. Mayer and Mr. Gimson, whom he described as three past-presidents of the Institution, on account of their enforced absence through illness.

Subsequently, in closing the technical session, the President expressed the indebtedness of the Institution to THE FOUNDRY TRADE JOURNAL, which was their official organ, and to its Editor in connection with the editing of the Papers and doing so much to give publicity to their work. He should like to say, on behalf of the members assembled, how very much they appreciated this valuable help, and he therefore proposed that their very best thanks be accorded to THE FOUNDRY TRADE JOURNAL, and particularly to the Editor, Mr. Faulkner, for the extremely valuable work they did on behalf of the Institution.

MR. J. ELLIS (Past-President) said he had great pleasure in seconding, and in stating that he was cognisant of the very useful work which THE FOUNDRY TRADE JOURNAL had done for them in the inauguration of the Institute. He doubted very much whether they would be in the proud position they were to-day but for the help and assistance of that paper. In coupling the name of Mr. Faulkner with the vote of thanks, he could assure them that no one worked more energetically for the Institution than Mr. Faulkner, particularly in reference to the London Branch, and especially for that Conference.

The proposition was carried by loud applause.

The Foundry Competitions.

By F. C. EDWARDS.

Of all the various sections in the Foundry Trades' Exhibition there is none more interesting than that of the Model Foundry. Indeed, judging by the huge crowd of spectators which gather around and fill the gallery overhead while the competitions are proceeding, it is safe to say this is far and away the most interesting section of all.

The great success of these competitions more than justifies the foresight and enterprise of the Technical Advisory Committee of the International Foundry Trade Exhibition, to whom belongs the honour of their initiation and control.

Three hundred competitors, from all parts of Britain, vie with each other in the various classes of work in their endeavour to secure highest marks for neatness, finish, initiative and speed. The enthusiasm of the competitors, and the general excellence of their work is really inspiring, and lightens the obviously stiff task of the judges. Correct and prompt answers are the rule, even from the youngest competitors. Some of these boys impart a grim seriousness to the situation. With the determined air of would-be victors, their shirt sleeves stripped high up on their shoulders, and with a brace of trowels stuck, Apache-like, in their quite manly belts, they are evidently out for scalps.

Occasionally, however, a gleam of humour brightens up the proceedings. The writer was both amused at the coolness of one very promising though diminutive youth. He was diligently arranging his wax vent in the core he was engaged upon, which was of ordinary sand, by the way. I asked him if he would vent every kind of core made out of that box. Without looking up or stopping for a moment in his work, he replied: "Wait a bit!" So far, his laconic answer lost him no marks. It showed that he was absorbed in his task, and wished to give a reasoned reply. The writer waited. In about half a minute he looked up and replied: "Not always; not if it was sea sand." This answer was, of course, quite correct for the type of core he was making.

Perhaps the greatest service rendered by these competitions—to the foundry trade in particular and to the community in general—is their highly stimulating effect upon the competitors, especially the younger ones. The desire to excel in one's chosen profession is probably the most laudable object of youth. The keenness and enthusiasm evinced is at once an indication and a guarantee that the competitions have engendered this desire in a very high degree.

Useful advice by the judges at the conclusion of the tests is another noticeable and valuable feature of the proceedings. It is bound to yield good fruit. As a result we may confidently expect that the various technical schools dealing with foundry practice and metallurgy will, next session, have overflowing classes of foundry students eager and determined to fit themselves for their job, and, incidentally, to secure one of the prizes at future competitions. That they will be of more value to their respective employers goes without saying.

Finally, these competitors cannot fail to foster a better understanding between employer and employee, manager and operative, without which no industry can hope to be happy and prosperous.

The thanks both of the trade and of the public are due to the donors of the substantial prizes, and to the officials concerned.

Personal.

THE LATE Mr. J. Bisset, managing director of R. B. Tennent, Limited, Whifflet Foundry, Coatbridge, N.B., left £6,666.

THE LATE MR. J. W. PICKERING, of J. W. Pickering & Sons, engineers and ship repairers, Liverpool, left £24,048, with net personalty £23,737.

MR. H. M. RIDGE, of the Ridge Roasting Furnace and Engineering Company, 2, Great Winchester Street, London, E.C., is paying a business visit to South Africa.

MR. HENRY MUSGRAVE, chairman of John Riddel & Son, Limited, iron and metal merchants, whose death occurred on January 2 last, left personal estate of the total value of £322,129.

MAJOR J. M. CAMPBELL, the son of Mr. James Campbell, of J. Wild & Company, Limited, Middlesbrough, is at present on a business trip through the Lake Superior ore districts.

MR. J. WEST, J.P., of West's Gas Improvement Company, Limited, a former president of the Institute of Gas Engineers, who died on January 12, left estate of the gross value of £78,510.

MR. JOHN BROCKHOUSE, J.P., of Hill Crest, Hill Top, West Bromwich, axle manufacturer, chairman and managing director of John Brockhouse & Company, Limited, left £38,368, with net personalty £23,519.

MR. A. S. BELL, for many years London representative of Bodill, Parker & Company, Limited, brassfounders, of Birmingham, has been appointed London and district representative of J. Russell & Sons, 2, Kirby Street, Hatton Garden, E.C.1.

THE council of the University of Leeds has appointed Dr. W. T. David, M.A., Cambridge, D.Sc., Wales, to be Professor of Civil and Mechanical Engineering, and to take up his duties next October on Professor Goodman's retirement from the chai

Deaths.

MR. E. EDWARDS, son of the late Mr. D. Edwards, founder of the Dyffryn Steel and Tinplate Works, Morriston, died recently, aged 60 years.

MR. HERBERT ELLIS, J.P., for some years chairman of Taylor, Taylor & Hobson, Limited, engineers, of Leicester, died recently, in his sixty-fifth year.

MR. F. M. WINTER, of Sheffield, died on Thursday of last week after an operation. Mr. Winter, who was a director of the firm of Ibbotson Bros. & Company, Limited, Globe Steel Works, Sheffield, was well known and highly esteemed in Sheffield commercial circles.

MR. F. COOKE, of Limefield, Greetwell Road, Lincoln, sole surviving partner in the firm of John Cooke & Sons, agricultural implement makers, Lincoln, died on Monday at Eastbourne. Mr Cooke was about 60 years of age. The business with which he was connected was established by his father, the late Mr. John Cooke, 60 years ago.

MESSRS. H. HAMPSON & G. HAMPSON, metal brokers, etc., Mill Lane, Hollinwood, Oldham, trading under the style of H. & G. Hampson, have dissolved partnership.

THE NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, have taken orders from the Caledonian Railway Company for twenty new locomotives. Hurst, Nelson & Company, Limited, Motherwell, are supplying the same railway with five hundred mineral wagons.

Semi-Steel.*

By J. Cameron (Kirkintilloch).

In making reference to "Semi Steel" it has to be admitted that the name is misleading and that it is desirable that proper specifications should be prepared for the various classes of this material. The name is popularly applied to the metal resulting from the use of mild steel added to the pig-irons and scrap melted in the cupola or furnace. The writer wishes to make it clear from the first that the semi-steel described in this Paper is produced in the cupola, using coke as fuel and the usual air-blast. His experience is confined to this practice, and the results obtained and conclusions put forward are the results of over twelve months' continual experience on a fairly large scale, and since then in greater variety of subject but on a smaller scale. The percentage of steel used varied from 15 to 40 per cent., the lower figure for light work, and the higher proportions for heavier castings.

Semi-steel does not displace either steel or malleable cast iron. The steel scrap in its passage down the cupola by absorbing carbon gradually loses its identity as steel and becomes iron. The metal resulting is simply a high-grade cast iron with fewer impurities and better physical structure.

Test-bars when pulled show no elongation, and there is practically no ductility.

It is the practice of some firms to melt steel scrap in the ladle and call the product semi-steel, but this method is seldom of any practical use. In the first place, the proportion of steel taken up by the molten iron is very small, not much over 5 per cent. in favourable conditions; the steel

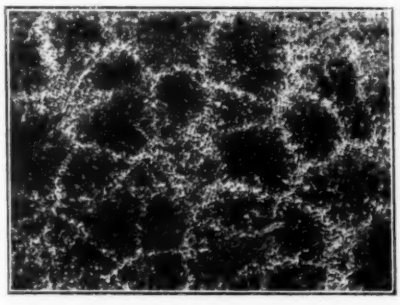


FIG. 1.—THE MICRO-STRUCTURE OF PROPERLY MADE SEMI-STEEL MAGNIFIED 100 DIAS., BUT REDUCED MORE THAN 50 PER CENT. ON REPRODUCTION.

does not have the chance of being properly mixed and has a tendency to show in patches of uneven grain and hardness.

Semi-steel is now being largely worked and its use steadily making headway, and the time has come now for the British Cast Iron Research Association, in co-operation with the Institute of British Foundrymen, to formulate a more correct and scientific name for the material and, if possible, prepare specifications and standard tests.

Ironfounders to-day are being called upon to produce castings of better quality which will machine satisfactorily, to meet the developments of higher speeds and greater efficiency in the engineering industries. They are asked to reduce weights; the standard of tests is being raised in many quarters, and all round more is being demanded. To maintain the use of cast iron for engine cylinders, turbines, compressors and innumerable classes of engineering and electric castings, the claims of semi-steel are well deserving of the most serious consideration.

Properties.

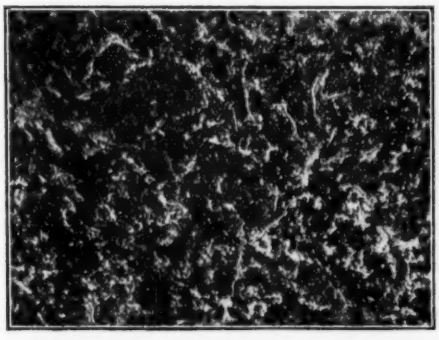
Semi-steel is stronger than usual grey cast iron as regards transverse, tensile, compression and impact tests. It is superior in regard to elasticity, toughness, resistance to shock and wear. Properly made, it is close grained, homogeneous, free from hard spots, blowholes or defects. The graphitic carbon is finely broken up, the phosphide eutectic small, well distributed and frequently in well defined mesh formation. Semi-steel is much superior to grey iron for machining. It takes a finer polish, while two very striking characteristics are its faculty for taking a clean-cut screw thread and a clean punch impression.

Owing to its good physical structure resulting from the close grain, the formation of the graphite, combined with its high tensile strength, semi-steel has proved satisfactory for such castings as cylinders, pistons, gear wheels and castings called upon to withstand wear and friction. Mr. McLain claims that it is a self-lubricating metal, and from general experience at home and abroad it has been found an excellent metal for the castings mentioned and for many other purposes.

From experience it has been found that when semi-steel has been supplied for various castings the buyer soon finds out its qualities, and in some cases asks for this material in all his castings.

Munitions.

The writer's introduction to semi-steel was in connection with munitions. Early in 1917 he subscribed to McLain's system, and towards the end



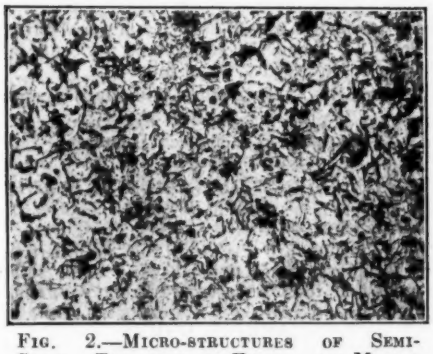


FIG. 2.—MICRO-STRUCTURES OF SEMI-STEEL. THE UPPER IS ETCHED AND MAGNIFIED AT 250 DIAS. AND THE LOWER UNETCHED AND MAGNIFIED 110 DIAS.

of that year, when approached by the Ministry, was able to undertake the manufacture of aerial bombs in this material. One cupola had been lined to 40 in. dia. on lines laid down by McLain and samples submitted. These proved satisfactory, and in a short time they were turning out semi-steel on a large scale. On one particular type of bomb 1,400 castings were produced daily. Our own Government were comparatively late in using semi-steel, although it had been proved satisfactory by our Allies the French and by the enemy. In America towards the close of the war a huge programme for the manufacture of semi-steel shells and bombs had been arranged. The specification for these called for a tensile strength of 32,000 lbs. on a bar cast 1¼ in. dia. machined to 1.128 in., and also for an impact test as follows:—

"The test specimen, 1½ in. square and not exceeding 1.52 in. on any side, shall be cast with a length of 8 in. and a riser of 4 in. After removal of the riser, the bar will be placed on two knife-

* A Paper read before the Birmingham Conference of the Institute of British Foundrymen.

edge supports 6 in. apart, which in turn are supported by an anvil weighing at least 1,750 lbs. A weight of 25 lbs. will be caused to fall exactly on the middle of the test-bar. The test will begin with the weight at a height of 12 in., and the test will be repeated with the height of the weight increased by ½-in. intervals until the bar breaks. The height of fall for causing rupture will not be less than 18 in., this height being measured from the upper surface of the bar to the lowest part of the testing weight."

Special air tests with soap solution for gas-shells and hydraulic tests of 4,500 lbs. per sq. in. for 6-in. calibre and under were also applied.

The results of actual use and experimental trials proved the usefulness and efficiency of semi-steel in shells and bombs, particularly as regards fragmentation. In view of the enormous demand for steel towards the close of the war, there is no doubt that semi-steel would have displaced steel in many instances.

Tests.

On over 400 test bars submitted to Ministry officials and tested by them the average result on a bar cast ⅞ in., dia. × 5 in. long was over 18 tons per sq. in. The average result on a bar turned from 12 in × 1 in. × 1 in. section gave 15 tons. It was anticipated that a fair number of bars submitted would fail to reach the minimum of 14 tons specified, but the results proved much more satisfactory than were hoped for.

The first bar to fail was No. 140, followed by a second failure in the same week. On investigation it transpired that the foreman had changed the usual moulder, who understood the correct gating, and when the bars were again made by him no other failure was recorded until after the armistice. The highest result yielded 21.9 tons, but this was beaten by Messrs. A. Ure & Company, of Glasgow, who attained 22.9 tons from a bar cast with 50 per cent. hematite pig.

Messrs. Diamond Foundry Company, Luton, using semi-steel on aerial bombs, had a wonderful run of 17 consecutive tensile tests, yielding an average of over 21.1 tons, maximum 22.8; minimum 18 tons.

Special Report, Technical College, Glasgow.

In April, 1918, three bombs and three test-bars, 15 in. × 1 in. × 1 in., were sent to the Technical College, Glasgow, for full report and criticism. Those marked A and D were from usual mixture, while B, C, F and G contained 50 per cent. hematite pig. The report is as follows:

THE ROYAL TECHNICAL COLLEGE, GLASGOW,
July 23, 1918.

MESSRS. CAMERON & ROBERTON, LIMITED,
KIRKINTILLOCH.

SPECIAL REPORT ON SEMI-STEEL AERIAL BOMBS.

DEAR SIRS,—

The following are the results of examination of three samples of aerial bombs and three samples of semi-steel test-bars received from you, marked as under:—

AERIAL BOMBS.

Ref. No.	...	358	349	357
Mark ...	...	A	B	C
Tot. C ...	...	3.251	3.270	3.279
Gr. C ...	...	2.766	2.820	2.822
C. C ...	...	0.485	0.450	0.457
Si ...	...	1.820	2.230	2.380
S ...	...	0.062	0.040	0.040
P ...	...	0.730	0.390	0.500
Mn ...	...	0.820	0.800	0.920

The general analyses suggest that the metal should be of medium hardness with high tensile strength, although the combined carbon might perhaps with advantage have been slightly higher.

The castings were very minutely examined for soundness and found to be good, solid metal throughout and singularly free from blow-holes or flaws.

Microscopical examination showed that in all cases the material was good, close-grained metal with small graphite regularly distributed.

In the case of B some segregation of the phosphide eutectic is shown, due probably to some accidental cause, such as high casting temperature, with quicker cooling, as, strangely enough, this sample is much lower in phosphorus content than the others. In A and C the phosphide eutectic is well distributed in a mesh work formation.

The matrix in all cases is pearlite of small striated variety with some ferrite, indicative of considerable strength with good flexibility.

Machining tests were carried out, and in all cases no difficulty was experienced in machining at a speed of 120 ft. per minute, a speed rather higher than is commonly given for soft cast iron. Practically no difference could be detected in the machining qualities of A, B or C.

This material is some of the best that the author has ever seen, and the small tensile bar cast on C gave a result of 20.7 tons per sq. in.

Transverse Test Bars.

15 in. × 1 in. × 1 in.

Analyses.

Ref. No.	...	354	355	356
Mark ...	...	D	F	G
Tot. C ...	...	3.409	3.426	3.279
Gr. C ...	...	2.899	2.848	2.690
C. C ...	...	0.510	0.578	0.589
Si ...	...	2.450	2.120	2.380
S ...	...	0.052	0.038	0.058
P ...	...	0.600	0.550	0.570
Mn ...	...	0.810	0.520	0.680

The analytical results are such as to suggest that the material would show maximum strength for tensile and transverse combined, and at the same time show good flexibility. This view is confirmed by Professor Longbottom's results, which show an average tensile strength of 15 tons per sq. in. and an average transverse of 26½ cwt. with a deflection of 0.12 in. under 2,500 lbs. (on 1 in. × 1 in. bar at 12 in. centres).

Microscopically, all bars show a structure indicative of strength and reliability. The graphite is in very small and uniformly distributed particles, with phosphide eutectic in an even mesh work formation.

The matrix in all cases is practically wholly pearlitic.

The bars were in every case perfectly sound and free from gas or blow-holes, and broke with a very fine close-grained structure.

Yours truly,
(Signed) A. CAMPION,
Professor of Metallurgy.

Pig-Irons.

In 1918 ironfounders had to accept such brands of pig-iron as were available. At this time most brands were erratic in analyses, particularly as regards silicon. The Scotch irons were found very suitable. Containing as they do total carbon about 3.60 per cent., medium phosphorus and manganese fairly high, they confirmed the popular dependence on their capacity for carrying scrap and blended well with mild steel scrap. The No. 1 quality was generally used, as machinability was most desirable. When a choice was available, preference was given to highest manganese. Some of the brands showed excellent fluidity, and when other brands were used the tensile strength invariably went up. Hematite irons used with steel scrap give very good results, and some remarkable tests have been attained by using 50 per cent. hematite. The steel scrap may be regulated to counteract the high total-carbon in hematite, which is frequently a source of trouble in grey-iron castings. Hematite was not available in 1918, or would have been more largely used. With a view of obtaining better tests, trials were frequently made of high-class irons, including cold-blast, special brands, and special cylinder pigs. The results, so far as tests were concerned, were invariably disappointing, as no increase resulted, but occasionally very fine metal was obtained.

One of the strongest arguments in favour of semi-steel is that a founder can use the common irons in everyday use, and by judicious mixing with steel scrap can obtain results only otherwise possible by the use of cold-blast or expensive special irons.

Scrap.

Mild-steel boiler-plate or sections used for stamping of thickness varying from ⅜ in. upwards in fairly large pieces may be used. There are brands of mild high tensile steel and high manganese

steel from which many varieties of stampings are made that give excellent results. Steel punchings 8 in. dia. of 1 in. thickness have been successfully tried.

Borings, turnings and small punchings under 1 in. dia. should be avoided, as they lead to troubles occasioned by oxidation, and frequently very small pieces drop into bottom of bed before being thoroughly melted—a frequent cause of hard spots.

Analysis.

The average analysis of aerial bombs referred to reads as follows :—

Si 2.13, S 0.065, P 0.60, CC 0.520, Gr C 2.55, Mn 0.624.

This is not claimed to be an ideal analysis, but proved to be satisfactory for the castings in question. It could be improved by lowering the silicon and increasing combined carbon and manganese. The above analysis yielded excellent tensile tests and was found to be easily machined. It may be stated that it was not possible to procure the pig-irons available in normal times and the best had to be made of the brands obtainable.

It will be noticed that total carbon is low, sulphur and phosphorus within safe limits. There is no doubt that greater strength would have been obtained by a closer approximation to Mr. F. J. Cook's silicon-carbon formula enunciated in his valuable Paper on Diesel engine castings or to the Continental empirical formula (total carbon

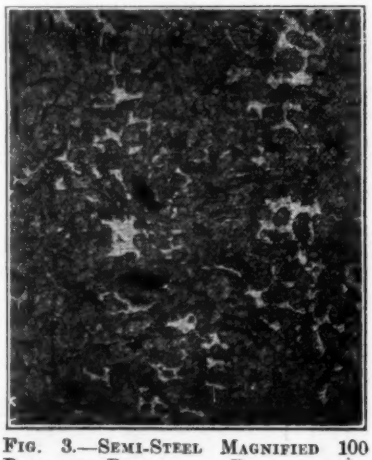


FIG. 3.—SEMI-STEEL MAGNIFIED 100 DIAS. BUT REDUCED ON REPRODUCTION. IT CONTAINS 1.03 PER CENT. P.

plus silicon=4.50), but it must be borne in mind that semi-steel freezes more quickly than grey-iron, and the problem was to cast very large quantities, the thickness being under $\frac{3}{8}$ in.

In semi-steel some interesting results in regard to silicon were noted. The analysis of the test bar illustrated in Fig. 3 was Si 2.35 per cent., CC 0.802 per cent. This bar was attached to the bomb and moulded in green sand. A gate about $1\frac{1}{4}$ in. dia. was taken away by an official of the Ministry, analysed and tested. Although the silicon was in this case over 3 per cent., the bar actually yielded a tensile strength over 18 tons. Silicon over 2 per cent. was frequently used in much heavier castings with good results. While a wide range of silicon was found harmless, semi-steel seems sensitive to phosphorus and sulphur. Cleveland iron is largely used by Scotch founders for their light work, and was tried for semi-steel. The resulting castings contained over 1 per cent., and were invariably brittle and lower in tensile strength.

The sulphur in analysis given is low, and was assumed as indicating good melting and good coke.

Recently in endeavouring to get harder semi-steel, harder irons and scrap were used. The coke obtained was during the miners' strike, and the hardness was obtained, but the metal was so sluggish that a Keep's test-bar, $\frac{1}{2}$ in. sq., would not run, and a 1 in. sq. bar was not machineable. The analysis of two days' results were:—

Si, 1.938 and 1.074; S, 0.150 and 0.143; P, 0.740 and 0.320; CC, 1.060 and 1.390; GrC, 1.82 and 2.04; and Mn, 0.260 and 0.340.

Two test-bars, 15 in. × 1 in. × 1 in. at 12 in. centres, resulted in transverse strength of 36.8 and 40 cwt.

Mr. Field, in his Paper "What is Semi-Steel? "* gave his sulphur content with 10 per cent. steel as 0.110 per cent., with 20 per cent. steel 0.125 per cent. The firm with which he is connected were turning out successfully the same bombs. With this percentage of sulphur it would have been impossible for the writer's firm even to pour the castings. Another "Perplexing Foundry Problem."

Mr. W. J. Evans, in a Paper† given to the East Midland Branch gave the following analysis:—

Si, 2.35; S, 0.051; P, 0.63; CC, 0.64; GrC, 2.66; and Mn, 0.76.

He stated that his semi-steel was used for intricate thin castings involving machining with expensive milling cutters. He remarks, "This is practically identical with the Scotch analysis. The tensile strength of this material is almost always over 16 tons per sq. in."

Semi-steel does not owe its qualities to chemical analysis so much as to its physical structure, and in its structure—almost identical with cold-blast iron—is revealed the secret of its strength and properties.

It is essential to ensure continuity of good results to make frequent microscopic examinations, or consult competent metallurgists. Analysis is excellent in itself, but must be considered in conjunction with the physical structure, and cupola practice.

Difficulties.

Semi-steel cannot be properly made under the too common "rule of thumb" methods. Consider-

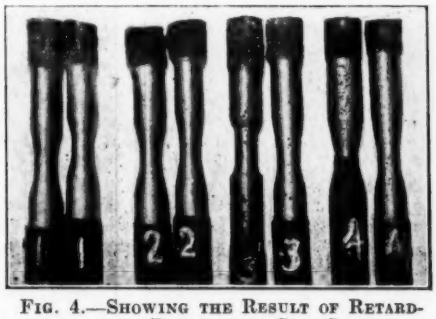


FIG. 4.—SHOWING THE RESULT OF RETARDING THE POURING OF SEMI-STEEL.

ably more care and organisation is necessary, and constant supervision essential. The cupola practice and fuel must be good, and everything entering the cupola must be accurately proportioned and weighed, especially *air*.

Correct gating is very essential. The gates and runners must be larger than for iron. Special skill and care and repeated trial should be given to the gating of every semi-steel job, particularly when required in large quantities and when several castings are in a flask.

It must be melted hot and poured quickly. Fig. 4 shows the result of retarding the pouring.

One disadvantage in regard to semi-steel is that while it is comparatively easy to maintain good results when worked daily on a large scale, the writer has to admit, after considerable experience, that to ensure the best results it has to be handled on a fairly large scale. When only one or two charges are required, they can certainly be produced and ordinary iron reverted to, but the results are never so good, so far as tests are concerned, as when melted on the larger scale.

Semi-steel is more sensitive to damp sand than grey iron. Sand should be as dry as possible, and the "swab" used with discretion. A development on the lines of very dry sand, sufficiently open, hard-rammed, is probably an improvement in the near future.

Cupola Practice.

This is a subject on which foundrymen hold varied opinions. Good results are sometimes obtained by unorthodox methods, and it is im-

*Appeared in "The Foundry Trade Journal," March 3, 1921.
† Appeared in "The Foundry Trade Journal" April 13, 1922.

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possible to lay down hard and fast rules. Whether the bed be high or low, whether one row of tuyeres or more should be used, depends on individual experience, on the nature of the blast, and the chemical and physical properties of the metal and fuel used. Each cupola should be made a special study in itself and persevered with, until it gives regularly from day to day its proper quantity of good hot metal and is clean at end of its day's work.

The writer in reference to cupola work can only speak from his own experience.

For semi-steel, a cupola about 36 in. to 42 in. inside lining is preferred. In this size control is easier and the air can be forced to the centre with comparatively little pressure. One row of tuyeres was used, placed as low as the fettling door permitted. To ensure soft blast, the tuyère area was increased to a 1 to 4 ratio, the tuyères forming practically a continuous belt. All metal and fuel charges were weighed, and at first air regulated by counting the revolutions of a positive blower, latterly by a blast volume-meter. The charges were small—10 cwt. of metal; each charge drawn by itself into bogie ladle and taken away for immediate pouring. These small charges, evenly distributed, seem to facilitate the free working of a cupola and maintain the melting zone at its proper level. Care should be taken with semi-steel to ensure *clean* metal scrap and fuel.

In more than one instance, when the bombs were cast from metal melted with high-blast and small tuyere-area, the resulting castings were hard and difficult to machine. On altering the tuyere area as indicated this defect was at once put right.

Melting of Steel.

From observation it was noticed repeatedly that when one or two charges of semi-steel were in the cupola the charge of ordinary grey-iron immediately in front when tapped gave indications of the presence of steel. From this it was concluded that the steel scrap, although invariably placed on top of charge, was melting before the pig-iron. Confirmation of this was obtained on Armistice Day when the cupola containing semi-steel charges was drawn just before blast was put on. Pieces of the steel scrap in the first charge had melted round the edges while the pig and iron scrap showed no signs of fusion.

Recently experiments have been carried out with a view of ascertaining the amount of carbon absorbed by mild steel when it melts. Bars of mild steel were placed in contact with incandescent coke under air-blast until fusion took place. Drillings were taken as near fusion point as possible, and at even distances of about 1 in. The results gave surprisingly low figures, the highest percentage being 0.648 of carbon, the average percentage of four bars being 0.530 carbon. The experiment was then repeated in a miniature cupola, filled with coke. Mild steel bars were inserted at 6 in. intervals, and each in turn brought down to the "melting zone."

The first results from trials in a 7-in. dia. cupola on 15 bars gave an average carbon content of 0.386 per cent. carbon. When repeated in 12-in. dia. cupola the average was reduced on six bars to 0.25 per cent. carbon. In the larger cupolette sufficient temperature was attained to procure masses of molten metal in the bed, and on analysis the total carbon absorbed in this case was 1.97 per cent.

An interesting feature was that in every case the melting took place on top of the bars. There were no facilities available for recording temperatures of cupolas, but the steel bars melted easily. The results were unexpected in the low amount of carbon absorbed at the melting stage, much larger figures being anticipated.

In actual practice, there is doubtless further absorption of carbon until, in the writer's opinion, about 2 per cent. is attained. This figure varies with height of bed and cupola practice generally.

Heat Treatment.

From trials it has been ascertained that when semi-steel is annealed at a temperature from 760 deg. to 800 deg. C. it loses considerable strength, in tensile strength the reduction varying from 25 to 33⅓ per cent., but the resulting metal was found to be very soft with a certain amount of malleability and ductility. Fig. 5 shows micro-photographs of a test bar as cast, heated to 760 deg. C. for two hours, then slowly cooled, reheated for a further four hours at 760 deg. C., and slowly cooled in muffle. Mr. McLain, in one of his pamphlets, shows a bar cast from white iron and steel scrap, which, after a prolonged heating, could be twisted.

As Cast, Unetched. | Same spot. Heated to 760 deg. C. for 2 hours and slowly cooled in muffle. | Same spot. Heated for a further 4 hours at 760 deg. C. and slowly cooled in muffle.

FIG. 5.—MICRO-PHOTOGRAPHS OF TEST-BARS SHOWING THE EFFECT OF HEAT TREATMENT. MAGNIFIED 100 DIAS., BUT REDUCED ON REPRODUCTION.

With semi-steel of the average analysis given the best results seem to be obtained by one annealing and slow cooling. Strength is reduced, and deflection slightly increased. To obtain more marked results low silicon and phosphorus with the carbon mostly in the combined state would be necessary.

In the Paper to be presented by Messrs. Campion and Donaldson some interesting and remarkable results have been attained by heat treatment of semi-steel at low temperatures, the loss of strength at temperatures up to 700 deg. C. being considerably smaller than shown by ordinary cast iron.

Literature.

In this country Mr. J. E. Hurst and Mr. M. Riddell were two of the early investigators. In Mr. Hurst's Paper, read at the 1915 Conference, he had not much to say in favour of semi-steel, except to admit its greater strength, but as he admittedly used steel borings, in the light of later experience he could only expect hard spots and other troubles. Mr. Riddell went fully into the

theory of the melting of steel scrap, the necessity for thorough mixing and enunciated the principal rules to be observed. He has gone further into the matter since then in a number of Papers to Branch meetings and elsewhere on this subject, and in connection with it, on cupola practice and fluidity.

Mr. Field's Paper, already referred to, contains some valuable information on the subject of semi-steel slags, and on the heat treatment and annealing effects and results.

The veteran Dr. Stead, in his presidential address to the Iron and Steel Institute in 1920,

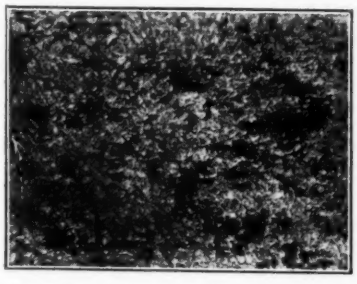

FIG. 6.—TYPICAL STRUCTURE OF STRONG SEMI-STEEL AFTER ETCHING. MAGNIFIED 100 DIAS., BUT REDUCED MORE THAN 50 PER CENT. ON REPRODUCTION.

made reference to two great advances in foundry practice during the last twenty-five years; first, the researches of Prof. Thomas Turner on the influence of silicon; and to the production of castings by melting mixtures of steel scrap and blast-furnace metal in the cupola, for they were much superior in toughness and strength to those made from furnace metal alone.

In the States, Mr. McLain has given many instructive lectures, and published pamphlets showing types of castings made from this material, with analyses and microphotographs. The late W. J. Keep repeatedly advised the use of steel scrap, and many interesting Papers have been published by Messrs. J. A. Dyer, W. J. Mulcahy, H. E. Diller, and many others. The American Radiator Co. did splendid service, and the record of their practice is well described in "The Foundry," December, 1918.

M. E. Ronceray's able Paper, "How Semi-steel Shells are being Made in France,"* is worthy of special attention. It describes how "fonte acierée" was carefully considered, then adopted on a large scale in France for shells and other munitions. The tests and analyses are given, the composition of the final product, with the effects of the various elements, particularly silicon, sulphur and phosphorus and full details of cupola practice.

In connection with French methods, the pre-war experiments on semi-steel shells by Major Rache and the Paper read by Lieut. Laurent† at the Milwaukee Convention of 1918 should be specially mentioned.

The fine record of achievement and results in munitions made during the war will undoubtedly lead to further developments in semi-steel both in respect to increased demand and in increased knowledge as to how ironfounders may get even better results than have hitherto been recorded. Cost is an important factor, but this is one of the main points in its favour.

When the conservatism of the average British founder will yield to acquiring the necessary scientific details, and become willing to undertake the care and supervision which this material calls for, the writer feels sure that semi-steel will not be confined to a comparatively small number of makers, but will become much more widely used and appreciated.

ADDENDUM.

Mr. J. E. Fletcher, M.I.M.E., has been good enough, in an unofficial capacity, to submit some notes on semi-steel practice based largely on his own experience and on Continental experience. These may be summarised as follows:—

(*A*) *Suggested Analysis to Ensure Best Physical Properties in Cylinder, Hydraulic Valves and Fairly Heavy Munition Castings.*

	Per cent.
Total carbon	2.8 to 3.2
Graphitic carbon ...	3.0 to 3.2.
Combined carbon ...	
Silicon	1.0 to 1.5
Manganese	0.6 to 0.9
Phosphorus	under 0.30

(*B*) *Relationship of Total Carbon to Silicon.*

For castings 2 in. thick and above, the total carbon per cent., plus Si per cent., should be 4.2; between 1 in. and 1¾ in. thick, it should be 4.3; between ½ in. and ¾ in. thick it should be 4.5; and between ¼ in. and ½ in. thick the figure 5.0 is given.

(*C*) *Cupola Practice.*

1. Hot and rapid melting is necessary so that the steel does not carburise too rapidly in its descent through the cupola.

2. The charges of steel scrap, pig-iron and coke should be light, the metal charge having a maximum depth of 4 in. to 5 in. when the coke used is in ratio of 1 to 10 of metal melted.

3. The coke used should be of the best, low in ash, high in carbon and of strong, physical character and reasonably porous.

4. The amount of air used should not exceed 30,000 cubic feet or, say, 2,300 lbs. weight per ton of metal melted.

5. The blast pressure should not exceed 8 oz. for 24 in. to 36 in. cupolas, 9 oz. for 36 in. to 48 in. and 10 oz. for 48 in. to 60 in.

6. The following figures, being the total tuyere area per cent. of the cupola area inside lining are suggested; for a cupola of 20 in. dia. the tuyere area should be 30 per cent.; for 40 in. dia. 25 per cent.; for 50 in. dia. 22 per cent.; for 60 in. dia. 20 per cent.

7. The depth of well or hearth of cupola below the tuyeres should not be too great, 15 in. to 18 in. being good practice.

8. The steel scrap should not be too thick or too thin (¼ in. minimum and ⅝ in. maximum is a good rule). Very short pieces are unsuitable as these tend, as in the case of turnings, punchings and the like to segregate and promote irregular fusion and carburisation.

9. The amount of air supplied per sq. in. of tuyere area per min. should not exceed 12 cub. ft., and the tuyeres should be well flared out at the inside of the cupola to at least twice the inlet area at wind belt. Flat rectangular shaped openings are better than circular ones.

10. From the above it is evident that high velocity of blast accompanied by high blast-pressures is prejudicial to good results. In actual practice, if each tuyere has an area (at inlet from wind belt) of 1/30th of the cupola area at the tuyere level, satisfactory results are obtained. A single row of tuyeres gives good uniform melting and generally better working than two or more rows of smaller tuyeres.

11. Such design as indicated in the foregoing fixes the velocity of the blast at about 28 ft. per sec. when traversing the tuyere inlet. (This in the case of 48 in. cupola.) For small cupolas this velocity may be reduced to, say, 22 ft., and for larger (60 in. and upwards) increased to 34 ft. per sec., being influenced by the amount of blast penetration necessary.

12. The height from tuyere level to bottom of charging door, governing the depth of stock column, is of importance, and for semi-steel practice may be given as 20 to 24 times the square root of the cupola diameter at tuyeres—

$$H = 20 \text{ to } 24 \sqrt{d} \text{ in ins.}$$

Thus a 36 in. cupola would have a height from tuyeres to charging door of—

20 to 24 times $\sqrt{36}$=120 in. to 144 in.

The higher figure is preferable as assisting rapid melting and economical working.

Mixtures.

The practice of making a semi-steel pig from a 40 per cent. (or 30 per cent.) steel mixture, and of using this in conjunction with pig-iron and scrap with or without a further 10 per cent. or 15

* "The Foundry," March, 1818.
† "The Foundry," November, 1918.

per cent. steel scrap yield good results, the metal being more homogeneous. It is bad practice to mix high phosphorus pig-iron with steel scrap owing to the different fusion points of low and high phosphorus metals.

Low total-carbon content in the pig-irons used is essential, otherwise the semi-steel will be too high in the total carbon, and weak in consequence. The oxidation losses are greater when using high carbon pig-irons, and tend to the production of porous oxide charged metal.

Too much emphasis cannot be placed on the necessity for high-temperature melting and casting. Obviously the higher fusion temperature of 3.0 per cent. carbon iron calls for considerable superheat if fluidity is to be obtained.

Moreover, the quicker the melting the less will be the degree of carburisation in the steel portion of the melted charge, and the lower the final carbon content of the metal produced.

Hematite pig-irons admittedly give the best results in semi-steel mixtures. If the total carbon content is 4.3 per cent. minus, say 0.29 per cent. for each per cent. of silicon content, a limit is reached. If the total carbon exceeds this the pig-iron is of the high carbon type and indicates high temperature blast conditions. Below this the graphitic condition is less coarse, and the pig-iron physically stronger. Thus the upper limit of total carbon for a hematite containing 3 per cent. silicon is 3.43 per cent. If higher than this the graphitic structure of the pig-iron will be normally coarse, and Mr. Fletcher believes this coarseness persists in the semi-steel made therefrom, the worse as the silicon content is higher in the semi-steel.

The high total-carbon evil is more pronounced with phosphoric irons. Mr. Fletcher has shown elsewhere that each per cent. of phosphorus displaces about 0.39 per cent. of carbon. Hence the basis limit in a pig containing 3 per cent. silicon,

C. Si P.

1½ per cent. phosphorus is $4.3-(3\times.29)-(1.5\times.39)$ or 2.9 per cent. total carbon. In some hot blast furnaces such a pig may reach 3.5 per cent. total carbon, and it is exceedingly difficult to keep the carbon low in such irons except in small furnaces using low temperature blast. Hence the common fact that high-silicon, high-phosphorus irons absorb carbon rapidly in the blast furnace hearth and in cupola, much more rapidly than do hematite irons. Mr. Fletcher has always agreed with the author in his view that phosphorus in semi-steels should be kept low—for the reason given. It is not improbable that the higher limit for carbon in hematites, by reason of the absence of phosphorus, helps the fluidity by raising the proportion of the 4.3 per cent. carbon eutectic in the metal when hot melting is practised.

An International Lunch.

Mr. Oliver Stubbs was the host at a luncheon given in honour of the foreign guests on Wednesday, June 21, at the Midland Hotel, its object being the furthering of international friendship. Amongst those present were Mr. Stanley Flagg, Junior, Past-President of the American Foundrymen's Association; Professor Enrique Touceda, of Albany, New York, the metallurgist who has done so much for the malleable industry; Mons. Ramas, President of the French Foundrymen's Association; Mons. E. V. Ronceray, of Paris, the well-known French foundry metallurgist; Mons. Leonard, President of the Belgian Foundrymen's Association; Mons. Varlet, of Liège, whose Paper on loam moulding was so much appreciated at the Conference; Mr. H. L. Reason, President of the I.B.F.; Mr. Frank Somers, of Halesowen; Mr. F. J. Cook, the Oliver Stubbs Medallist, and Past-President of the I.B.F.; Col. W. F. Cheesewright, D.S.O.; Mr. T. H. Firth, Past-President of the I.B.F., who accompanied Mr. Stubbs on his American tour; Mr. H. Cole Estep, of "The Foundry"; and Mr. V. C. Faulkner, of THE FOUNDRY TRADE JOURNAL.

Mr. Oliver Stubbs, in a few well-chosen words, welcomed his guests, and stated that everything possible was done to make the visit of the British delegates to the States as enjoyable as possible, and he hoped that the guests would take back with them to their various countries an equally good impression of British hospitality. During his stay in the States he had been assured that Britain had only to say the word, and American foundrymen would charter a boat, and three to four hundred would take pleasure in visiting our country.

Replying on behalf of America, Mr. Flagg thanked Mr. Stubbs for the hospitality the American delegates had received. British foundrymen would always be welcomed in the States. He had not the slightest hesitation in saying that his countrymen would support wholeheartedly any scheme of an International Conference, as such an affair could only make for international concord and progress.

Mons. Ronceray, speaking on behalf of Mons. Ramas, stated that at the last meeting of the French Foundrymen's Association they initiated a scheme for an International Congress in 1922 at Paris, but they had not thought to include the Americans on account of distance, but if they would come French foundrymen would be only too delighted to receive them.

Extreme cordiality was evinced when the toast of Mr. Stubbs' health was proposed by Mr. Reason. Mr. Cook and Mons. Ronceray voiced the thanks of guests to Mr. Stubbs for his kindness and foresight in arranging what was truly an international lunch party.

Foundry Competitions.

The following is a list of prize winners at the competitions held during the run of the International Foundry Trade Exhibition at Bingley Hall, Birmingham.

Class A.—Coremaking.

Light Castings.—First prize, G. Green, Smethwick; second prize, H. Ridgeway, Smethwick.

Medium Castings.—First prize, J. Bishop, Birmingham; second prize, W. Glover, Willenhall.

Heavy Castings.—First prize, R. C. Clarke, Small Heath; second prize, W. G. Riley, Ladywood. Consolation prize in the entire class, H. Ridgeway, Smethwick.

Class B.—Moulding.

Floor Moulding.—First prize, J. Charley, Darlaston; second prize, J. Scott, Sunderland; third prize, P. London, Bilston.

Two-Part Moulding.—First prize, J. Hartshorne, West Bromwich; second prize, H. Millard, Cape Hill; third prize, W. Stevens, West Bromwich.

Three-Part Moulding.—First prize, L. Ramsbottom, Darlaston; second prize, A. McBride, Crewe; third prize, J. A. McIndoe, Aston. Consolation prize in the entire class, T. Stubbs, South Shields.

The first prize-winner in each case also received the Exhibition Diploma.

Class C.—Patternmaking.

Blue Ribbon Prize of the Exhibition.—T. Haines, Newark.

For Competitors Over 21 Years.

First prize, H. Sutcliffe, Halifax; second prize, W. Jeans, Inverness; third prize, C. J. Millward, Birmingham; fourth prize, G. Croft, Hexham-on-Tyne.

For Competitors Under 21 Years.

First prize, H. Grayer, West Bromwich; second prize, W. L. Leek, West Bromwich; third prize, J. Oddy, Smethwick.

For Technical School Students.

First prize, W. W. Graw (West Bromwich), County Technical College, Wednesbury; second prize, G. J. Botfield (Birmingham), Handsworth Technical School. Consolation prize for the entire class, P. Thomas, Handsworth.

The first prize-winner in each case also received the Exhibition Diploma.

MR. J. M. LONGYEAR, whose death was announced from Boston, U.S.A., was largely responsible for the development of the iron ore deposits of northern Michigan, and joined Mr. F. Ayer, of Boston, in financing the Arctic Coal Company, which held large mining rights in Spitzbergen.

Trade Talk.

DORMAN, LONG & COMPANY, LIMITED, are blowing-in a blast furnace at their Redcar works.

MELDRUMS, LIMITED, Timperley, near Manchester, booked 18 orders during May for their fuel economy apparatus, many of which were repeat orders.

THE BACARES IRON-ORE MINES, LIMITED, Broom & Wade, Limited, and T. M. Birkett & Sons, Limited, have joined the Federation of British Industries.

T. C. JONES & COMPANY, LIMITED, scrap iron and metal merchants, are opening a small tools department at 93, Wood Lane, Shepherd's Bush, London, W.12.

AN order for three electrically-driven motor-ships, each of about 4,000 tons gross burden, has been placed with Messrs. Cammell, Laird & Company, of Birkenhead, by the United Fruit Company of Boston, America.

THE FIRE which broke out at the Ilford branch of J. H. Sankey & Son, Limited, recently, did considerable damage to a large shed and an amount of stock, but fortunately the offices and the most important buildings, plant and stock were uninjured.

MR. J. E. SAYERS, consulting engineer and electrician, Ocean Buildings, 190, West George Street, Glasgow, has assumed Mr. T. G. Crum, who has been his assistant for several years, as a partner. The business will now be carried on under the style of James E. Sayers & Company.

IN the month of May there were three vessels of 4,690 total net register tons launched in the Tyne as compared with four vessels of 11,200 total net tons in May last year. From January 1 to May 31 this year 14 vessels of 47,925 total tons were launched, as compared with 35 vessels and 102,966 tons in the corresponding period last year.

OWING to the slackness of trade the Siemens shop and several of the bar mills at Messrs. Alfred Hickman's Steel Works, Bilston, have not been restarted since the holidays. This has thrown a further 800 to 1,000 men out of employment. The four blast furnaces are still going, but it is not likely that the departments just closed will be reopened for some time.

THE HULL meeting of the British Association will be opened in the City Hall on Wednesday, September 6, when Sir C. S. Sherrington will be elected president in succession to Sir Edward Thorpe. The sectional meetings start on the morning of Thursday, September 7, on which day the Civic Reception will also be held. There will be the usual Citizens' Lectures, excursions, and other entertainments.

THE DRAFT HAS BEEN ISSUED of No. 1 Order under Part II. of the Safeguarding of Industries Act, which has been laid before the House of Commons for approval by resolution. This order imposes a duty of 33⅓ per cent. *ad valorem* upon imports from Germany on, among other articles, domestic hollow-ware, decorated or not: (1) aluminium, and (2) of steel or wrought-iron enamelled. The order will continue until August 19, 1924.

"PROGRESS towards trade reconstruction has been phenomenally fast," declared Mr. Arthur Balfour, managing director of one of the great Sheffield steel firms, speaking at a luncheon given in his honour by the American Chamber of Commerce, at the Hotel Cecil. "We can see to-day for the first time," he added, "a general return of confidence which six months ago did not exist. People are realising that the cost of production has reached as low a point as it is going to reach, and are beginning to make up their minds to buy. Capital and labour are getting into close grips and understand one another better, and instead of the uneconomic wage settlements of the Government are making settlements which are economic and which make possible the production of goods at prices that people can pay."

MR. AMBROSE CALLIGHAN, secretary of the West Coast branch of the National Federation of Blast-furnacemen, interviewed at Workington on June 14, said that the fact that the production of pig-iron in this country had risen from 288,000 tons in January to 407,700 tons in May was a very hopeful sign. According to the returns, the output of iron was increasing at a percentage equal to that of the United States, and faster than that of France, Belgium and Germany. As the United States felt the slump first, they were feeling the effects of trade revival first. The figures furnished proof of England's ability to regain her old position in the world's markets. Mr. Callighan also called attention to the fact that steel production between January and May had exceeded that of pig-iron by 383,100 tons, and that if their works were to be kept going they would have to increase the make of pig-iron. He looked for a slow but sure improvement in trade, and he believed that by the end of the year they would have as many furnaces in blast on the North-West Coast as there were in a period of average trade.

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IRON AND STEEL MARKETS.

Pig-iron.

Reports from most centres of the pig-iron industry suggest gradually resuming activity, the improved inquiry for foundry qualities especially pointing to an early revival of demand by consumers, whose works have been compulsorily idle during the recent disturbances in the engineering branches, and whose stocks must be depleted by this time. In the West of Scotland the outlook is regarded as hopeful, as evidenced in the fact that during the past week three additional furnaces were relighted, bringing the total number up to fifteen, all with the exception of one on hematite producing foundry pig. The export demand at Glasgow is hardly as active as previously reported, shipments from the Clyde indicating a decrease in volume as compared with the corresponding figures for last year. In the Midlands, there has been some accumulations of stocks at furnaces, but prices remain undisturbed for both Derbyshire and Northamptonshire brands, values, if anything, showing an upward tendency. In the Cleveland pig-iron market export inquiry is rather more active, Germany and Mid-European consumers buying on a fairly substantial scale, while during the past week two cargoes, totalling about 4,000 tons of foundry iron in addition to extensive purchases of ferro-manganese iron, were booked on American account. It is also satisfactory to note that Tees-side productive resources are again being extended.

Finished Iron.

A much more confident tone is expressed in most branches of the finished iron trade than has been evidenced of late, and although recovery to normal conditions must necessarily be slow, signs of awakening interest are already apparent. This was notably the case at last week's Birmingham market, which was very fully attended, and at times even animated, although the volume of actual business transacted was only about the average. Makers of marked bars find demand for this class of material still inadequate to keep mills employed at full capacity, while producers of the crown and common quality bars report little improvement in demand. The resumption of work at the engineering establishments may, however, be expected to bring an early improvement in this direction.

Steel.

The termination of recent labour troubles, and resumed activity in the engineering shops, has had a welcome tonic influence on the steel industry, and if the progress made is necessarily slow at first, there can now be no doubt that movements in the trade are becoming accelerated. The initial effect of this change in conditions is evidenced in much freer buying in the Sheffield market for semi-products, both basic and acid billets being in better demand, for which, at present quotations remain stationary, though an advance in prices is quite expected in the near future.

Tinplates.

The gradual reduction of tinplates in stocks indicates the steady tendency of business, the market continuing to reflect a fair volume of buying demand inclining mostly to sales for prompt delivery, for which a premium of about 3d. per box is readily conceded. The home trade is quietly steady. A moderate amount of business has been fixed up on a basis of 19s. 6d. for cokes, net cash, f.o.t. at works, delivery over third quarter of the year. I C 14 x 20 cokes are in fair demand for export, and are realising 19s. 7½d. to 19s. 9d. per box, f.o.b. Wales, for spot delivery. For August-September sales at 19s. 3d. to 19s. 6d. are reported. I C 28 x 20 were done on about the same basis for Continental account. Coke wasters are in quiet demand, with prices practically unchanged on the week.

Scrap.

In the Midlands markets there is a fairly good demand for heavy steel scrap, heavy steel turnings and bundled steel shearings, and prices are considerably firmer. Holders, however, are not anxious to sell, expecting that in the near future that better prices will be offered. Usually, where sales are made, steel scrap is realising 55s., and steel turnings, 42s. 6d., whilst bundled steel shearings are fetching 48s. 6d. The condition in the wrought-iron scrap market, on the contrary, shows no signs of improvement, although dealers are still asking 75s. for heavy wrought iron and 65s. for bushelling iron. There is no increase in the demand for cast-iron scrap for foundries, and merchants have difficulty in realising 75s. for heavy and 60s. for light. It is, however, expected that these conditions will improve when the engineers are more fully employed.

Metals.

Copper.—A consistently steady tone has prevailed of late in the market for standard copper, influenced it may be assumed by a cessation of labour troubles at home, and a hope that cheaper money will assist in the trade revival now in progress. Copper values at the moment must be regarded as reasonable enough to tempt buying on a better scale, while the unsold stocks in the United States will probably continue to fall in prices for some time yet in spite of increased production. Refined descriptions are firm, with electrolytic quoted £69 to £70 10s., and wire bars £70 10s. *Cash* quotations:—Wednesday, £61 15s.; Thursday, £61 15s.; Friday, £61 10s.; Monday, £61 12s. 6d.; Tuesday, £61 10s.

Tin.—Fluctuations in values of standard tin of late have been confined within comparatively narrow compass, and markets generally may be pronounced steady in tone. The metal now stands at prices which should certainly encourage consumptive purchases which is, however, gradually improving both at home and in America, so that notwithstanding the heavy stocks accumulated at Eastern ports, current shipments are speedily absorbed. With the gradual restoration of normal trade conditions it is fairly safe to predict an early upward tendency in prices. *Cash* quotations:—Wednesday, £152 7s. 6d.; Thursday, £152 5s.; Friday, £152 15s.; Monday, £152 12s. 6d.; Tuesday, £152 7s. 6d.

Spelter.—Conditions in the market for spelter have undergone little change during the current week, and prices continue at about previous levels. *Ordinary* quotations:—Wednesday, £27 15s.; Thursday, £27 15s.; Friday, £27 10s.; Monday, £27 12s. 6d.; Tuesday, £27 15s.

Lead.—The market for soft foreign pig continues firm in tendency, the current price ruling about £24 7s. 6d. for prompt delivery. Restricted imports, with an immediate increase of demand, would doubtless influence an appreciation in values. *English* quotations: Wednesday, £26; Thursday, £26; Friday, £26; Monday, £26; Tuesday, £26.

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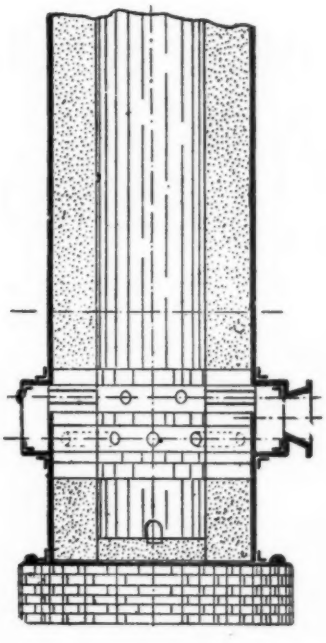

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Iron	91.57	92.21	92.31	92.46	92.83	93.75	93.85	94.14
Graphite	3.25	3.00	2.98	2.90	2.95	2.60	2.00	0.60
Combined Carbon	0.18	0.23	0.33	0.45	0.50	0.60	1.50	2.80
Silicon	3.25	2.80	2.60	2.40	2.00	1.40	0.90	0.56
Sulphur	0.02	0.03	0.05	0.06	0.07	0.10	0.15	0.30
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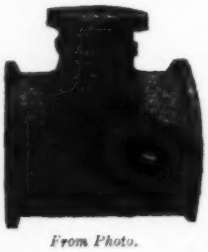

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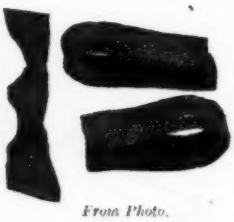

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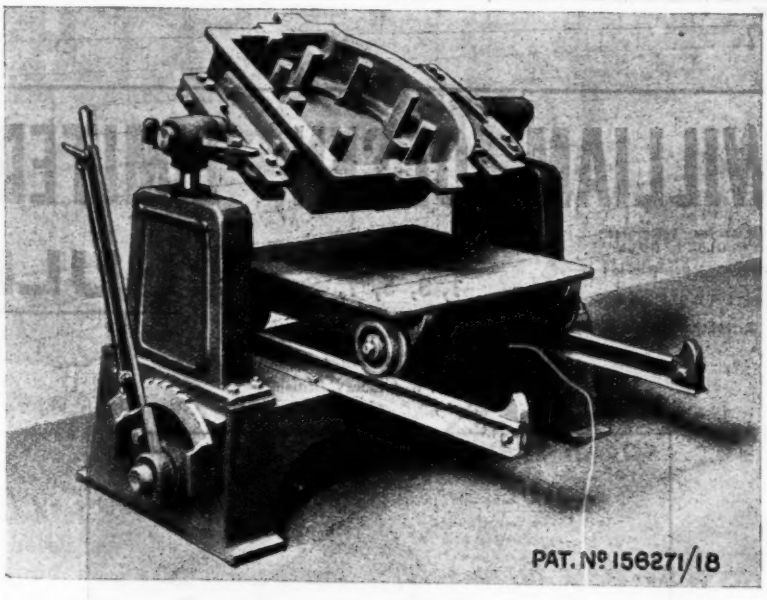

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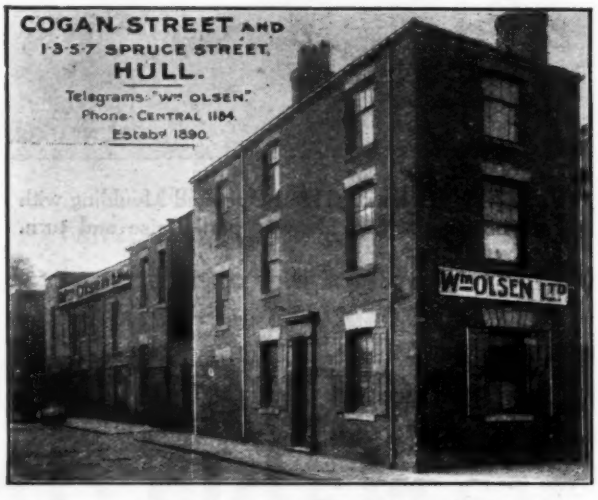

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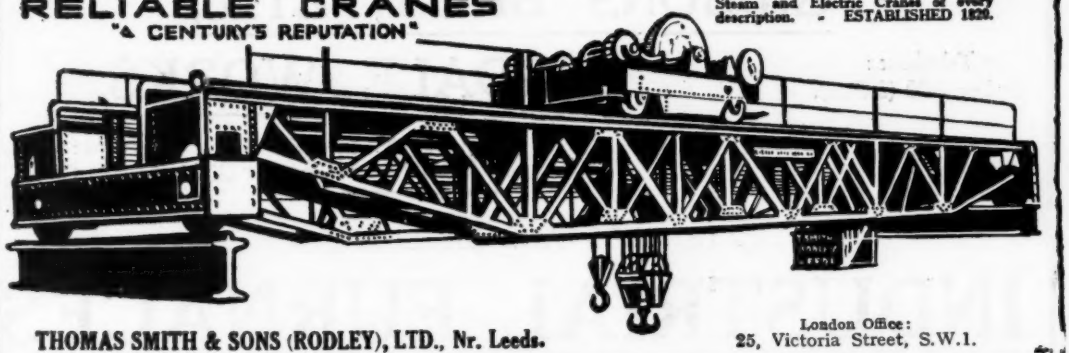

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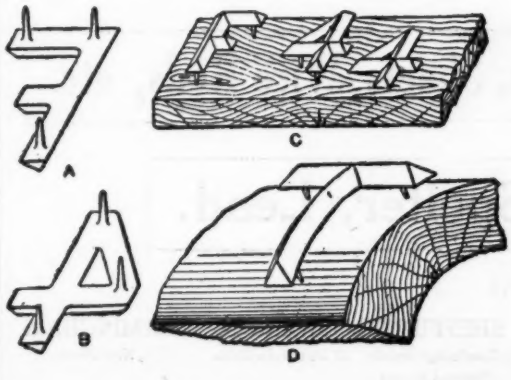

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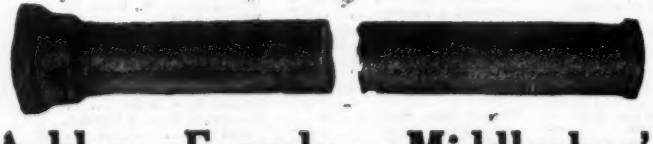

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Flats under 1 in. by ½ in. to ¼ in. by ¼ in., and all sizes over four times in width over thickness	3d. lb.
Bevels of approved sizes and sections	6d. lb.
If in coils	3d. lb.
Packing	£3 ton.
Bars cut to length	10% extra

Scrap from high-speed tool steel—

Scrap pieces	3d.
Turnings and swarf	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£	s.	d.
South Wales—			
Heavy Steel	3	12	0
Bundled steel & shearings	2	19	0
Mixed iron & steel	3	1	0
Heavy cast iron	3	15	0
Good machinery for foundries	4	1	0
Cleveland—			
Heavy steel	3	2	0
Steel turnings	2	5	0
Cast-iron borings	2	5	0
Heavy forge	3	7	6
Bushelled scrap	3	2	6
Cast-iron scrap	3	15	0
Lancashire—			
Cast iron scrap	4	5	0
Heavy wrought	3	5	0
Steel turnings	2	2	6
London—			
Copper (clean)	54	10	0
Brass (clean)	29	0	0
Lead (less usual draft)	22	0	0
Tea lead	20	0	0
Zinc	16	0	0
New aluminium cuttings	65	0	0
Braziery copper	44	10	0
Gun metal	39	0	0
Hollow pewter	120	0	0
Shaped black pewter	70	0	0

Above are merchant's buying prices delivered yard.

PIG-IRON.

N. E. Coast—	
Foundry No. 1	95/-
Foundry No. 3	90/-
Forge No. 4	85/-
Mottled	80/-
Hematite No. 1	94/-
Hematite M/Nos.	93/-
Midlands—	
Staffs. common	—
„ part-mine forge	—
„ „ foundry	—
„ Cold blast	240/-
„ basic	—
Northants forge	70/- to 72/6
„ foundry No. 3	77/6 „ 80/-
„ basic	82/6
Derbyshire forge	75/-
„ foundry No. 3	82/6
„ basic	80/-
Scotland—	
Foundry No. 1	100/-
„ No. 3	95/-
Hematite M/Nos.	110/-
Sheffield (d/d district)—	
Derby forge	82/6
„ foundry No. 3	86/6
„ basic	—
Lincs. forge	86/6
„ foundry No. 3	86/6
„ basic	86/6
E.C. hematite	111/-
W.C. hematite	115/-
All d/d in the district.	
Lancashire (d/d eq. Man.)	—
Derby forge	—
„ foundry No. 3	92/6
Northants foundry No. 3	—
Cleveland foundry No. 3	—
Staffs. foundry No. 3	—
Lincs. forge	—
„ foundry No. 3	—
Summerlee foundry	112/-
Glengarnock foundry	114/6
Gartsherrie foundry	114/6
Monkland foundry	112/-

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.
Bars (crown)	£11 to 12	0	0
Angles	12	10	0
Tees to 3 united ins.	13	0	0
Nut and bolt	10	0	0
Hoops	14	0	0
Marked bars (Staffs.)	13	10	0
Gas strip	11	7	6
Bolts and nuts, ¾ in. × 4 in.	22	0	0
Steel—			
Ship plates	10	0	0
Boiler plates	13	10	0
Chequer plates	10	10	0
Angles	9	10	0
Tees	10	10	0
Channels	8	15	0
Joists	10	0	0
Rounds & squares 3-in. to 5½in.	10	10	0
Rounds, under 3in. to ¾in.	9	10	0
Flats, over 5in. wide and up	10	0	0
Flats 5in. to 1¼in.	8	10	0
Rails, heavy	9	10	0
Fishplates	14	10	0
Hoops	12	0	0
Black sheets, 24 g.	12	0	0
Galv. cor. sheets, 24 g.	15	15	0
Galv. fencing wire, 8 g. plain	16	0	0
Rivets, ½ in. dia	15	0	0
Billets, soft	7 5 0 to 7	10	0
Billets, hard	8	0	0
Sheet bars	7 7 6 to 7	15	0

PHOSPHOR BRONZE.

	Per lb basis.
Strip	1 3
Sheet	1 3½
Wire	1 3½
Rods	1 2½
Tubes	1 6
Castings	1 1

Delivery 3 cwt. free to any town.

10% phosphor copper, £40 above price of B.S.

15% phosphor copper, £50 above price of B.S.

Phosphor tin (5%), £30 above price of English ingots.

CHARLES CLIFFORD & SON LIMITED, BIRMINGHAM.

NICKEL SILVER, SHEET METAL, WIRE AND TUBES.

	Per lb.
Ingots for raising	11d. to 1/5
Rolled—	
To 9 in. wide	1/5 to 1/11
To 12 in. wide	1/5½ to 1/11½
To 15 in. wide	1/6½ to 2/0½
To 18 in. wide	1/7½ to 2/1½
To 21 in. wide	1/8½ to 2/2½
To 25 in. wide	1/9½ to 2/3½
Ingots for spoons and forks	11d. to 1/5
Ingots rolled to spoon size	1/2 to 1/8

Wire round—

3/0 to 10. G. 1/8½ to 2/3½ with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	26.82
No. 2 foundry Valley	24.00
No. 2 foundry, Birm.	18.50
Basic	26.96
Bessemer	26.96
Malleable	26.46
Grey forge	25.46
Ferro-manganese 80 % delivered	70.82
Bess. rails, h'y, at mill	40.00
O.-h. rails, h'y, at mill	40.00
Bess. billets	35.00
O.-h. billets	35.00
O.-h. sheet bars	35.00
Wire rods	38.00
	Cents.
Iron bars, Phila.	1.96
Steel bars	1.70
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.70
Skelp, sheared steel	1.70
Steel hoops	2.40
Sheets, black, No. 28	3.15
Sheets, galv., No. 28	4.15
Sheets, blue an'l'd, 9&10	2.40
Wire nails	2.40
Plain wire	2.25
Barbed wire, galv.	3.05
Tinplate, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	32/6
„ furnace	22/6
Durham & North. foundry	28/-
„ furnace	23/6
Other Districts, foundry	27/6
„ furnace	22/6

SWEDISH IRON.

Bars, hammered basis sizes Basis price £24 to £25

Rolled Ordinary— Assortment .. £ 17 s. 0 d. 0 to 17 10 0

Nail Rods— Square, round and flats ..

Keg Steel nom. £38 to £40

Faggot Steel nom. £30 to £32

Blooms— Single welded .. £11 to £12

Billets— Single and double welded £13 to £14

Pig-Iron— Grey, white or mottled £8 12 6 to £9 0 0

Prices are without engagement. All quotations are f.o.b. Gothenburg, net cash against documents there.

TUBES.

Up to and incl. 6 in.

Gas .. 55% } Tube prices
Water .. 50% } are
Steam .. 45% } now free.

TINPLATES.

I.C.Cokes,	20×14, box	19/9
„	28×20, „	39/6
„	20×10, „	27/9
„	18¾×14, „	20/–
I.X.	„	45/–
I.X.X.	„	51/–
F.C.B.Y.	21×13⅝ „	37/6
C.V.B.G.	16½×15, „	34/9
I.C.W.	20×14, „	17/6
„	28×20, „	35/6
„	20×10, „	24/3
„	18¾×14, „	18/–
Terneplates,	28×20, „	36/–

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.	
June 21	61	15	0	dec. 7/6
„ 22	61	15	0	No change
„ 23	61	10	0	dec. 5/–
„ 26	61	12	6	inc. 2/6
„ 27	61	10	0	dec. 2/6

Electrolytic Copper.

June 21	69	0	0	No change
„ 22	69	0	0	„
„ 23	69	0	0	„
„ 26	69	10	0	inc. 10/–
„ 27	69	10	0	No change

Standard Tin (cash).

June 21	152	7	6	No change
„ 22	152	5	0	dec. 2/6
„ 23	152	15	0	inc. 10/–
„ 26	152	12	6	dec. 2/6
„ 27	152	7	6	dec. 5/–

Tin (English ingots)

June 21	152	0	0	dec. 10/–
June 22	152	0	0	No change
„ 23	153	0	0	inc. 20/–
„ 26	153	0	0	No change
„ 27	153	0	0	„

Zinc Sheets (English).

June 21	36	0	0	No change
„ 22	36	0	0	„
„ 23	36	0	0	„
„ 26	36	0	0	„
„ 27	36	0	0	„

Spelter (ordinary).

June 21	27	15	0	dec. 2/6
„ 22	27	15	0	No change
„ 23	27	10	0	dec. 5/–
„ 26	27	12	6	inc. 2/6
„ 27	27	15	0	„ 2/6

Lead (English).

June 21	26	0	0	No change
„ 22	26	0	0	„
„ 23	26	0	0	„
„ 26	26	0	0	„
„ 27	26	0	0	„

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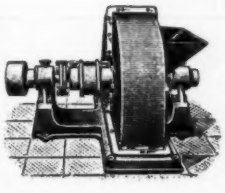

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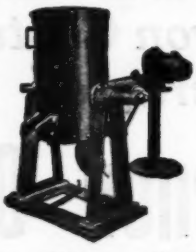

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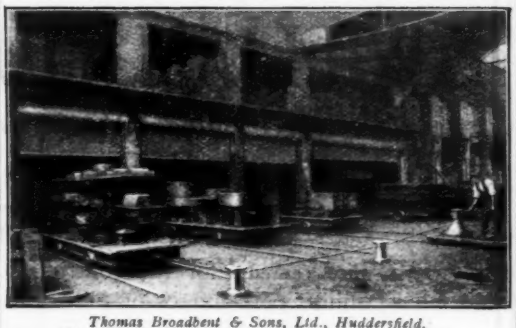

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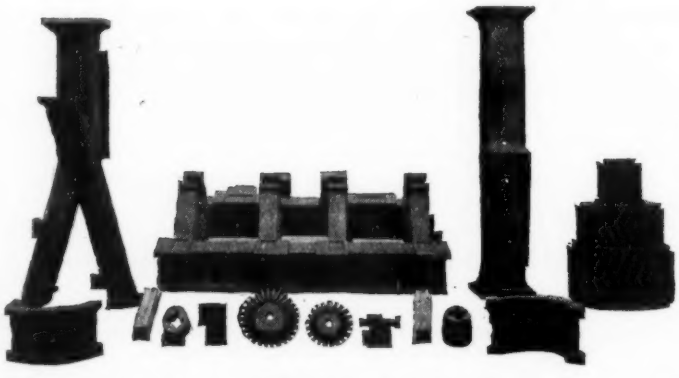

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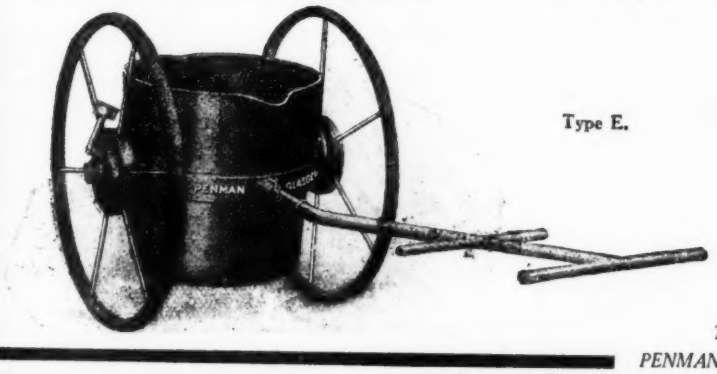

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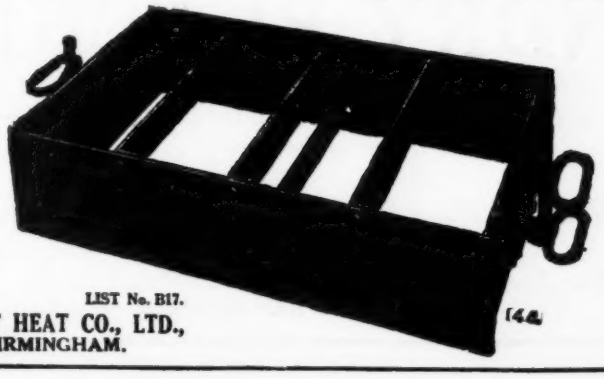

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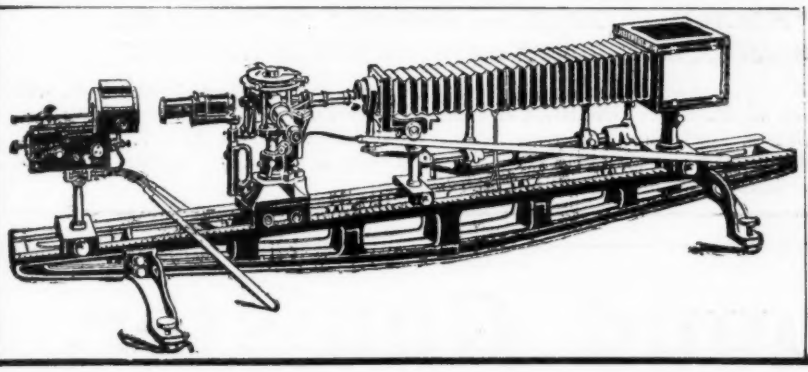

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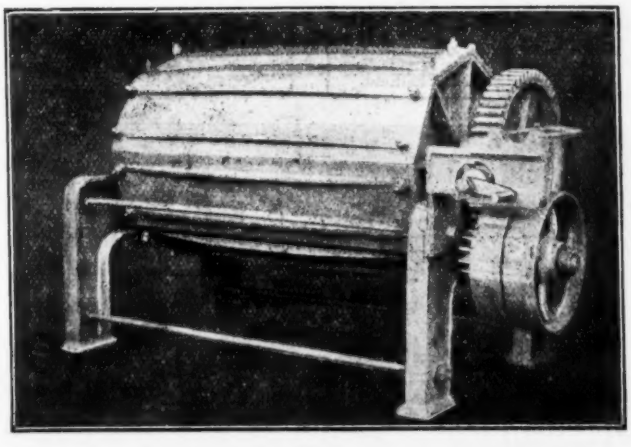

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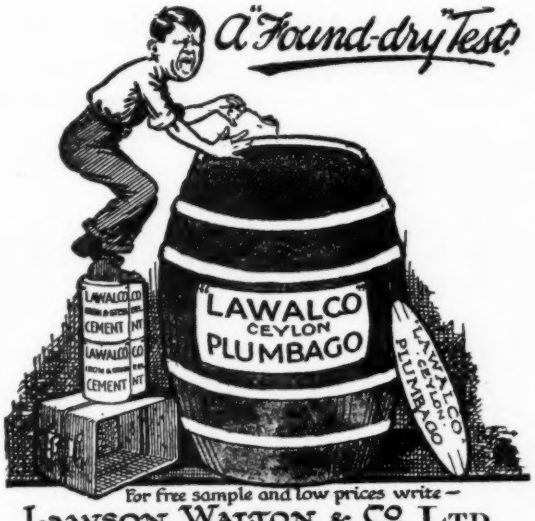

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